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U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 39
HENRY W. HENSHAW, *Chief*

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WOODPECKERS IN RELATION TO TREES AND WOOD PRODUCTS

Smithsonian Institution
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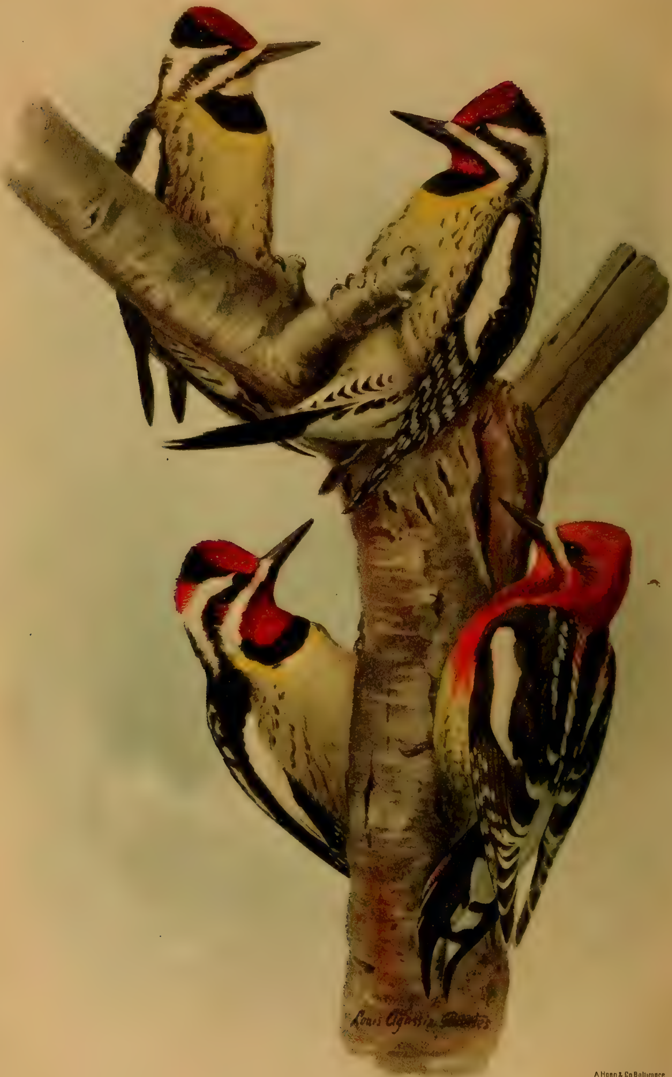
National Zoological Park

BY

W. L. McATEE
Assistant Biologist, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911



A Hoen & Co Baltimore

YELLOW-BELLIED, RED-NAPED, AND RED-BREASTED SAPSUCKERS.

[Upper figures, yellow-bellied sapsuckers; lower left, red-naped sapsucker; lower right, red-breasted sapsucker.]

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., May 24, 1911.

Sir: I have the honor to transmit herewith, for publication as Bulletin No. 39 of the Biological Survey, a report on Woodpeckers in Relation to Trees and Wood Products, by W. L. McAtee, assistant, Biological Survey. Woodpeckers as a family take high rank among our insectivorous birds, and being specially equipped to dig into wood for hidden larvæ inaccessible to other birds aid materially in the conservation of our forests. Three members of the group, however, the only ones properly known as sapsuckers, are injurious, since their chief purpose in digging into trees is to secure the cambium and the sap for food. The holes they make also permit entrance of moisture, bacteria, and fungi which injure and sometimes destroy the tree. They also cause staining of the wood, seriously impairing its market value when converted into lumber. Altogether the damage done by sapsuckers in the United States amounts yearly to not less than $1,200,000. This bulletin treats of the more strictly economic aspects of woodpecker work, and points out wherein the birds are beneficial and wherein injurious, and in the latter case suggests remedies.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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WOODPECKERS IN RELATION TO TREES AND WOOD PRODUCTS.

INTRODUCTION.

Woodpeckers are peculiarly dependent upon trees, which furnish them food, shelter, and cradles for their young. No birds are more highly specialized nor more perfectly adapted to a particular mode of life than are most woodpeckers to arboreal existence. Moreover, as trees are important to woodpeckers, so are these birds important to trees. Woodpeckers benefit trees by consuming many of the most destructive forest pests, insects largely inaccessible to other birds. In securing these insects, however, which constitute the bulk of their food, and in making nests and shelter cavities, woodpeckers have another significant economic relation to trees, for they remove bark and wood from both dead and living trees. In the case of dead trees little or no harm is done. When, however, they make excavations in living trees, the birds destroy more or less of the cambium layer, from which proceeds the growth of both wood and bark. Slight injuries to the cambium result in distorted growth, but the destruction of large areas may cause death. Since trees are exceedingly valuable to man, the habits of birds whose relations to trees are so vital are of much economic importance.

It is the purpose of this bulletin to examine the evidence for and against woodpeckers and to determine their status according to the effect of their habits upon trees and wood products. Injuries by woodpeckers are treated under two heads: (1) Damage by woodpeckers in general; (2) injuries due almost exclusively to the three species properly known as sapsuckers.

DAMAGE BY WOODPECKERS IN GENERAL.

This topic may be divided into two sections: Damage to trees, and damage to wooden posts and structures.

DAMAGE TO TREES.

Primarily the work of woodpeckers on the living parts of trees is injurious. The important cambium layer is injured every time a nest is excavated or an insect dug out. To what extent the various injuries are offset by beneficial activities of the birds will be discussed later.

HOLES MADE IN DIGGING OUT INSECTS.

As a rule the holes made by woodpeckers when digging out insects are not large, and there is every reason to believe that most of them heal quickly without noticeably disfiguring the exterior of the trees. They cause distortion and staining of the wood, however, as do all injuries to the cambium. These defects often resemble those which result from sapsucker work, but they generally occur in otherwise unsound trees and are much less numerous and important. However, wounds made by woodpeckers when digging out borers deeply buried in the wood, by reason of their larger size, often result in bleaching the wood (see Pl. III, fig. 6), a feature rarely observed in connection with the smaller sapsucker pecks.

Our two largest species of woodpeckers, the pileated and the ivory-billed, dig great pits or furrows in living trees or split off large chips. Plate III, figures 1 to 5, illustrates large wounds made by pileated woodpeckers. F. M. Chapman says: "I have seen an opening made by a pileated woodpecker in a white-pine tree 12 inches long, 4 inches wide, and 8 inches deep, through perfectly sound wood to reach the larvæ at work in the heart of the tree."[1] These large woodpeckers occasionally riddle trees which show no signs of insect attack, but this is so unusual as not to warrant hostility toward these fine birds, which are disappearing only too rapidly as man encroaches upon their domain.

All woodpeckers chip off considerable wood from dead trees and branches to secure the insects therein. In spite of the good done by destroying these insects, in some countries woodpeckers are held in disrepute because they reduce the quantity of firewood, a view not likely to be adopted in the United States.

Indeed, the offices of woodpeckers in capturing the various wood-boring insects may be likened to those of the surgeon who removes diseased parts from the human body. Not only do we deem the surgeon's achievement praiseworthy, but we pay him well for doing it. We should maintain the same attitude toward the woodpeckers, surgeons to our trees. Practically all the compensation they demand is the privilege of excavating nests and sleeping shelters in trees.

EXCAVATION OF NEST AND SHELTER CAVITIES.

There are 24 species (and several subspecies) of woodpeckers in the United States, and although most of them usually select dead stubs or limbs or partly decayed trees in which to make their nests, nearly all of them at times choose living trees. Some use living trees almost exclusively and dig a new hole each year; others occupy the same nest year after year. The Williamson sapsucker is one of the species which habitually nest in living trees. Joseph Grinnell relates that in the San Bernardino Mountains tamarack or lodgepole pines (*Pinus murrayana*) are selected by that species as nest trees, usually old ones with the core dead and rotten but with a live shell. In one tree he noted a series of 47 holes which penetrated the trunk on all sides up to about 35 feet. Besides these there were many smaller drillings. When once selected by these sapsuckers a tree is doomed, but probably not more than 1 tree in 500 is appropriated by the birds.[1]

---

[1] Chapman, F. M., Color Key to N. A. Birds, p. 148, 1903.

ATTACKS OF TREE ENEMIES AIDED BY WOODPECKERS.

Unlike the surgeons of the human body, woodpeckers neither close the wounds they make nor apply antiseptic treatment, but leave the cuts open to infection. Hence an opportunity is given for a host of enemies, such as bacteria, fungi, and insects, to enter the wound and further injure the tree. While the birds are at fault in so far as they create conditions allowing the inception of damage by these formidable tree enemies, it is evident that blame for all the ensuing injury can not be placed upon them, and it must be admitted that insects, fungi, and bacteria do immense damage with which woodpeckers are in no way connected. It should not be overlooked, however, that old woodpecker holes are of use also to many friends of trees, as they furnish nesting sites for bluebirds, titmice, chickadees, and other insectivorous birds.

COMPENSATION FOR INJURIES DUE TO FOOD AND NEST EXCAVATIONS.

After all, however, the question to be decided in regard to the injuries incident to insect hunting and nest excavating by woodpeckers is: Do the services the birds render in destroying the enemies of trees outweigh the damage they inflict? In Bulletin 37 of the Biological Survey it is shown that most woodpeckers destroy vast numbers of the worst pests of trees, many of which are inaccessible to other birds.

This service by no means exonerates those species properly called sapsuckers, nor does it free from blame woodpeckers which attack structures valuable to man. It does mean, however, that in general we can safely ignore the minor injuries committed by woodpeckers in pursuance of their natural mode of life, and that in practically all cases (with the exceptions noted) woodpeckers living in forests, groves, or orchards do a great deal more good than harm.

---

[1] Grinnell, Joseph, Univ. Calif. Pub. Zool., V, 64–65, 1908.

DAMAGE TO WOODEN POSTS AND STRUCTURES.

However, when woodpeckers depart from their normal activities and inflict injuries in no wise essential to securing sufficient food or proper shelter, we are not bound to pass over the offenses so lightly as those above discussed. Probably the most serious damage resulting from a change of habits is the hollowing out of telephone poles for nest or shelter cavities, so weakening them that they snap off in high winds.

DAMAGE TO TELEPHONE AND TELEGRAPH POLES.

The red-headed woodpecker (*Melanerpes erythrocephalus*) in some sections commonly chooses telephone poles as nesting sites. The Pennsylvania Telephone Co., of Harrisburg, reports that some years ago many costly poles were destroyed by this species, and Mr. Howard F. Weiss, of the Forest Service, states that 110 out of 268 white cedar poles along a southern railway were bored by this bird. The bird once became a nuisance to the Kansas City (Mo.) Electric Car Co. by drilling the poles carrying the feed cables. A man employed to kill them destroyed 19 in one day.[1]

A related species, the golden-fronted woodpecker (*Centurus aurifrons*), does similar injury in Texas. Mr. H. P. Attwater says: "Here their favorite nesting sites are in telegraph poles, and there are few that are without woodpecker holes, as they appear to make new ones every year. . . . A line running out of San Antonio to a ranch 9 miles distant was almost destroyed by these birds. They came from all sides, from far and near, and made fresh holes every year, sometimes as many as five or six in a single pole.[2]

Sennett made similar observations on the same bird in the Rio Grande Valley. He says: "The square Government telegraph poles are its favorite nesting place. There is hardly a pole free from their holes, and in one I counted ten; probably some were made by their only relative of that section, *Picus scalaris*, Texas woodpecker."[3]

Farther west a woodpecker, probably the Gila woodpecker (*Centurus uropygialis*), has been a source of trouble and expense to the Southern Pacific Co. for several years, especially along the 200 miles of road between Benson, Ariz., and Guaymas, Mexico. Mr. C. T. Day, assistant superintendent of telegraph on the Sonora division of this railway, says that between Nogales and Guaymas, Sonora, a great many poles have been lost on account of woodpeckers. "We are now changing some 300 poles on this account," he writes. The poles injured "are round cedar, square redwood, and also round creosoted poles; the latter were only placed within the line within the last two or three years. The square poles seem to suffer the most; in many cases we find five or six holes of 3 or 4 inches in diameter in one pole. It seems to be the object of the woodpeckers to dig into the pole for insect life, which the pole may contain, although we find places where they have made nests. The hum of the wires, I think, has something to do with attracting the birds to the poles, which sound they take to be insect life in the pole." (Aug. 17, 1910.)

---

[1] Bryant, J. A., Osprey, I., 147, Aug., 1897.

[2] Quoted by Bendire, C., Life Histories of N. A. Birds, II, 125, 1895.

[3] Sennett, Geo. B., Notes on the Ornithology of the Lower Rio Grande of Texas. Bull. U. S. Geol. and Geog. Survey Terr., IV, 39, 1878.

Besides the species already mentioned, the following are known to injure telephone poles to a greater or less degree: Texan woodpecker (*Dryobates s. bairdi*), St. Lucas woodpecker (*Dryobates s. lucasanus*), California woodpecker (*Melanerpes f. bairdi*), red-bellied woodpecker (*Centurus carolinus*), yellow-shafted flicker (*Colaptes auratus*), and red-shafted flicker (*Colaptes c. collaris*). The California woodpecker, besides making nest cavities, perforates the entire surface of poles with small holes in which to store nuts. (See Pl. IV, fig. 1.) However, "decay is the great cause of destruction of poles. It is estimated that approximately 95 per cent are destroyed by this cause and only 5 per cent by breakage or mechanical abrasion."[1] How much of the breakage is due to the weakening of posts by woodpeckers is unknown, but the damage is nowhere near as great as commonly supposed. Mr. Howard F. Weiss, of the Forest Service, discusses the effects of woodpecker attack on poles, in the Engineering News of February 23, 1911 (vol. 65, No. 8, p. 220), from which we quote at length:

> The number of holes in each pole may vary from one to a dozen or more, although these larger numbers are not common. The size of the hole varies from about ½ to 3 inches diameter. When used for nesting sites the birds may hollow out a pocket 6 to 10 inches in diameter and a foot or more in depth.
>
> The question of interest to telephone engineers is to just what extent such poles are weakened. The following example may be of interest. It has been found from measurements on two hundred and fifty 30-foot northern white-cedar poles that their average taper is approximately as follows:

Circumference (inches).	Distance from butt (feet).
43	0
37	5
36	6
34	10
32	15
29	20
27	25
24	30

---

[1] Bureau of Census, Forest Products, No. 10, p. 106, 1909.

Assuming the pole as a cantilever, loaded at one end, it is found that it may be hollowed to the extent shown in the figure without decreasing its strength. The length of ordinate between shaded area and right-hand edge of the diagram represents the thickness of outer shell which must be sound. For example, at 10 feet from the ground if only 2 inches of the outer shell are left, the pole will be approximately as strong as though it were solid. This grants the bird permission to build a house about 6 inches in diameter. The higher up the pole it goes the larger can be its nest without injury. If, however, the attack is less than 4 feet from the ground the pole will be appreciably weakened.

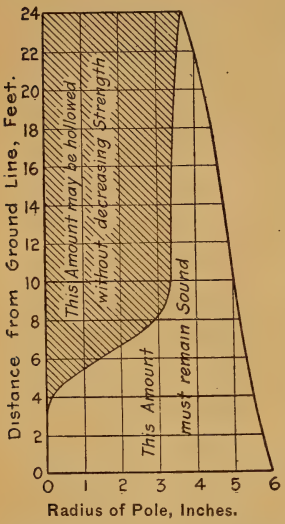


Diagram showing the extent to which a pole can be hollowed by birds without appreciably decreasing its strength.

This illustration neglects the damage done by the entrance into the pole, or the subsequent decay which may follow, and assumes that the bird builds its nest exactly in the center—a condition not always found in fact. On the other hand, it assumes that the pole has a uniform moisture per cent throughout its length and that the outer fibers at the ground line are perfectly sound. These conditions seldom, if ever, exist in practice, as the pole, particularly if it has been set for a year or more, always contains more moisture near the ground than at any point above it, and the sapwood at the ground is invariably more or less decayed. Hence, the birds could peck even larger holes than those shown in the sketch without increasing their damage.

The engineering department of the American Telephone & Telegraph Co. made a few tests in 1908 near Zanesville, Ohio, to determine the effect of woodpecker attacks upon the strength of poles. These tests were made by fastening a rope around the top of the pole and pulling with a block and tackle to which a dynamometer was attached. In 9 cases out of 12 the poles broke at the ground line and not at the points attacked by the birds. The examples in the accompanying table are typical.

Typical results of tests of damaged poles; American Telephone & Telegraph Co., Zanesville, Ohio.

	Pole No. 6390.	Pole No. 6325.	Pole No. 6372.
Material	Cedar	Cedar	Cedar.
Wires	44	44	44.
Length	35 feet	35 feet	35 feet.
Circumference, at ground (original)	43½ inches	42½ inches	40½ inches.
Circumference below ground (minimum)	38½ inches	42 inches	38 inches.
Circumference, point of load	31 inches	31½ inches	27 inches.
Diameter bird hole	6 inches	8 inches	(See note.)
Distance of hole above ground	9 feet 6 inches	24 feet	
Distance of load point above ground	25 feet	26 feet	
Broke off at	Ground		Ground.
Under corrected load	520 pounds		1,100 pounds.
Set in	Earth	Rock	Earth.
Top reflection (maximum)	2 feet 11 inches	5 feet 7 inches	
Butt reflection (maximum)	1 foot 3 inches	5 inches	
Estimated breaking weight	1,200 pounds	3,000 pounds	2,000 pounds.

After pole No. 6390 broke as above shown it was reset and tested as a 30-foot pole, and it broke at the new ground line (40½ inches circumference) under 1,000 pounds corrected load. It had a 2½-inch shell at break. Estimated breaking weight as a 30-foot pole, 2,500 pounds.

Pole No. 6325 was sound at the ground and set in wet rock hole, with about 10 inches of clay on top. At 3,000 pounds, actual reading, the dynamometer slipped. The load was applied for 300 pounds more, when the rope broke and test was abandoned.

Pole No. 6372, at 1,100 pounds, corrected load, gave way at ground, but did not quite break off. There were 10 woodpecker holes between 15 and 20 feet above ground, as follows:

13 feet above ground	3 by 3 inches, 4 inches deep.
17 feet above ground	3 by 3 inches, 5 inches deep.
18 feet above ground	3 by 3 inches, 3 inches deep.
19 feet above ground	3 by 3 inches, 5 inches deep.

At fifth gain, 30-inch circumference, 6 smaller holes.

It appears, therefore, that the attack of poles by these birds is not as serious as one would be prone to believe, and, taking into account the great good that they do in eating insects, the destruction of our feathered friends can by no means be justified by the injury they do to pole-line construction.

DAMAGE TO FENCES AND BUILDINGS.

The downy, hairy, Texas, California, and red-headed woodpeckers and both the yellow-shafted and the red-shafted flicker are known to excavate holes in fence and gate posts, but the loss is much less than in case of telephone poles. Indeed, it is probable that in most cases where woodpeckers nest in fence posts about yards and farms the owner is glad to have them there because of the number of insects they destroy. To say the least, it would be an advantage to have them nest in fence posts rather than orchard trees, for instance, and they would still visit the trees to glean insects.

As woodpeckers excavate poles and fence posts, it is not surprising that they attack other wooden structures. The usual type of injury of this class is drilling holes into cornices or under eaves of houses or piercing the walls of barns and sheds.

Buildings that are unoccupied most of the time, as schoolhouses and churches, are frequently defaced, church towers or steeples being favorite points of attack. The red-headed woodpecker is an old offender in this respect, and a case is recorded[1] where in one season 22 of these birds were killed one after another while attempting to make a nest in a church steeple. During the caretaker's absence a pair finally completed a nest and reared their young. The red-bellied woodpecker also sometimes makes holes in houses, but the flickers—the yellow-shafted in the East and the red-shafted in the West—are the woodpeckers that show the strongest predilection for boring into buildings. Often many holes are made in the same wall. (Pl. V, fig. 1.) Apparently the birds learn little by experience, but keep on drilling openings into large cavities unsuited for either nests or shelter. When occupied houses are attacked, the loud calls and racket made by the birds, especially in the early morning, are very annoying to the inmates.

---

[1] Stroop, L. J., American Naturalist, IV, 692, 1870.

The California woodpecker (*Melanerpes f. bairdi*), besides making holes in houses for nests or sleeping quarters, also pecks in cornices a multitude of small holes, wherein acorns are wedged. The bird usually stores the mast in dead limbs of trees, but when acorns abound near buildings it naturally takes advantage of the large exposed surface of dead wood as exactly suited to its purposes. This hoarding instinct undoubtedly has for its basis the provision of food for future use, but the woodpeckers store up immense quantities of acorns which they never eat, most of which fall to the lot of the squirrels and jays.

H. W. Henshaw found the California woodpecker making much use of buildings for storage purposes near Ukiah, Mendocino County, Cal. He was informed that one schoolhouse (Pl. IV, fig. 2) was so much injured in a season or two that it was replaced by a new building in preference to making the necessary repairs.

PREVENTION OF DAMAGE BY WOODPECKERS.

The prevention of damage by woodpeckers (except sapsuckers) rarely necessitates destruction of the birds. Moreover, woodpeckers are so valuable as conservators of trees that the public should not be deprived of their services.

It has been claimed that creosote insures telegraph poles against the attacks of woodpeckers, but Mr. Weiss presents evidence to the contrary in the paper previously quoted from (pp. 11–13), and Mr. C. T. Day says concerning results in Sonora:

> Some of the creosoted poles about 9 or 10 inches in diameter have been picked, leaving an outside shell. In two or three instances the linesmen have found the inside of poles entirely eaten away . . . and found birds' nests inside. It is a common expression with the linesmen that the woodpeckers get fat on creosote. We tried spraying with carbolic acid in places where their holes were just begun, but so far we have been unable to notice any difference. We are now substituting a Texas pine pole, burnetized, with a creosoted butt, which is claimed to be so much harder than creosote that birds will have considerable difficulty in getting into it. We have some 200 poles up, but as yet they do not show any marks.

The results of experiments of this kind will be awaited with interest. It will be fortunate, indeed, if some one or other of the preservative treatments which are applied to nearly all poles now being set is found to protect them from woodpeckers. As telegraph poles are usually perforated by woodpeckers for the purpose of securing nesting sites, the providing of nest boxes may prove a comparatively cheap and easy solution of the difficulty. If nest boxes be supplied and utilized by the birds, the poles should be reasonably exempt from attack. Those suitable for woodpeckers (similar to that illustrated by figs. 1 and 2) cost 25 cents each in lots of 20 or more. They may be used to protect trees, fence posts, and buildings, as well as telegraph and telephone poles.

Among native species flickers and the golden-fronted and red-headed woodpeckers have been known to use nest boxes, but few trials of them have been made in the United States. However, such experiments have proved very successful in Europe, as the following account of their utility in Germany, where they have been employed extensively, shows:

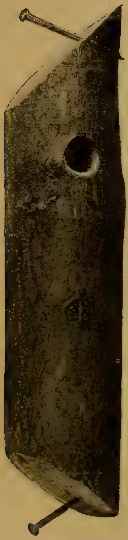


FIG. 1.—Homemade nest box for woodpeckers.

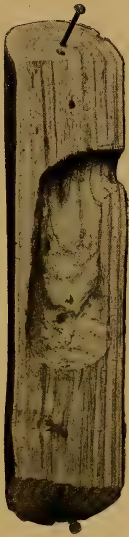


FIG. 2.—Longitudinal section of nest box shown in figure 1.

> Wherever these nesting boxes have been hung up, great success has been the result. All the breeders in holes . . . have inhabited them. . . . Ninety per cent of the 2,000 boxes in the wood at Kammerforst . . . and nearly all of the Seebach and of the 2,100 near Cassel were occupied. . . . The Prussian board of agriculture has caused extensive experiments to be made with these boxes, with excellent results. Of the 9,300 boxes hung up by the Government in the State and communal woods of the Grand Duchy of Hesse, 70 to 80 per cent were used the first year, and all have been inhabited this year (1907).[1]

---

[1] Heisemann, M., How to Attract and Protect Wild Birds, pp. 45–46, 1908.

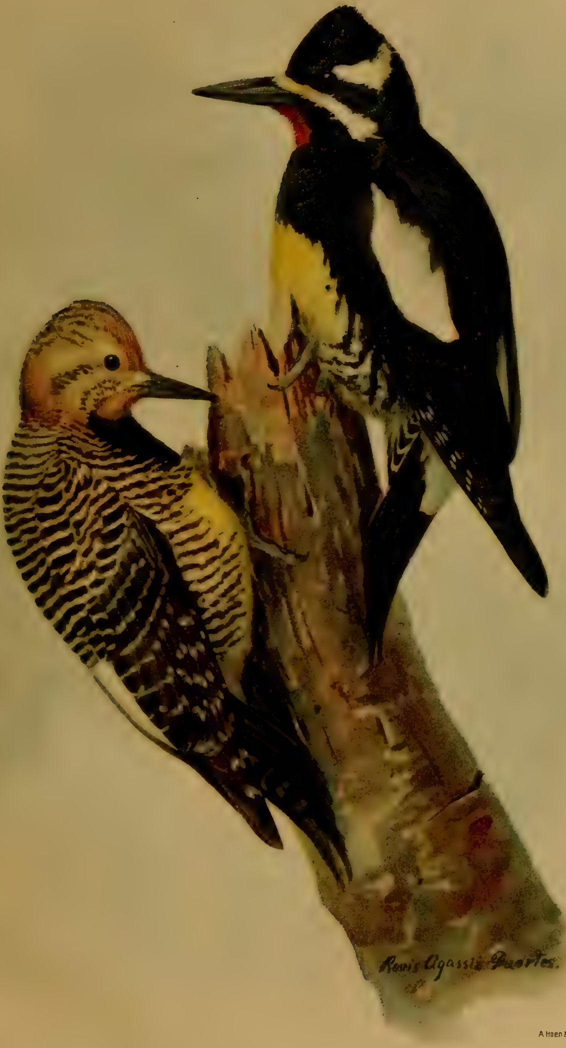
It is sometimes practicable to prevent damage by woodpeckers by covering objects with tin. This does not apply to buildings, of course, and when injury continues despite nest boxes and other protective devices more strenuous action is permissible. Do not try to kill the offenders by putting out poisoned food or water, for you will kill more friends than enemies. Some States properly permit the shooting of birds by the owners of premises that are manifestly being damaged. Shooting should be allowed only when actual damage is being done and then only under supervision of a proper authority.

DAMAGE BY SAPSUCKERS.

DISTRIBUTION AND HABITS OF SAPSUCKERS.

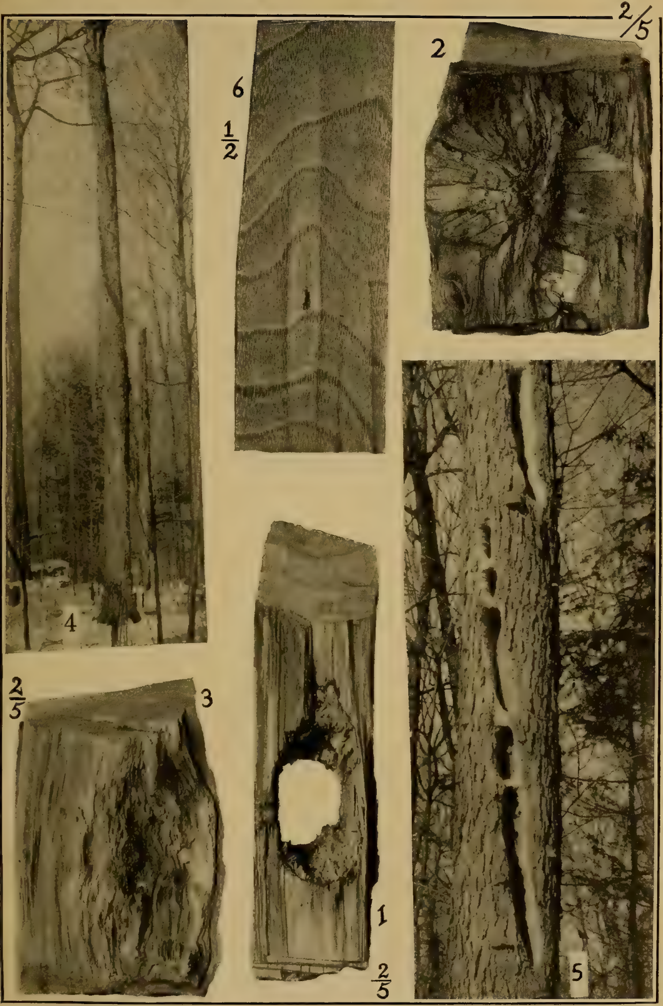
Many woodpeckers are commonly termed sapsuckers, but there are only three species properly so called: The yellow-bellied sapsucker (*Sphyrapicus varius*) (Pl. I), the red-breasted sapsucker (*Sphyrapicus ruber*) (Pl. I), and the Williamson sapsucker (*Sphyrapicus thyroideus*) (Pl. II). The yellow-bellied sapsucker (known also as red-throated sapsucker, squealing woodpecker, and whining woodpecker) together with its western form, the red-naped sapsucker (*Sphyrapicus varius nuchalis*), ranges over practically the whole of North America up to 60° north latitude, breeding from the northern limits of the range south to Massachusetts, Indiana, Colorado, and throughout the Rocky Mountain region, and migrating over the remainder of the continent as far as the West Indies and Central America. It sometimes winters as far north as the southern boundary of the breeding area. The red-breasted sapsucker, locally called the red-headed woodpecker, nests from northern Lower California through the Sierra and Cascade Mountain Ranges to southern Alaska, withdrawing in winter to that part of its range south of middle California. The Williamson sapsucker, the male of which was long known as the black-breasted and the female as the brown-headed woodpecker, occupies in summer the higher parts of the country from the eastern slopes of the Rocky Mountains to the Pacific coast, from Arizona and New Mexico to southern British Columbia, and winters from Texas and southern California south through the greater part of Mexico.

The sapsuckers are a distinctly marked group of woodpeckers and are held by some authorities to constitute a separate subfamily. Most woodpeckers have long tongues which can be thrust far out of the beak and which are armed at the tip with backward projecting spines (fig. 3), enabling the birds to secure their insect prey although deeply buried in wood. The sapsuckers, on the contrary, have short, practically nonextensible tongues, furnished with a fringe of stiff hairs (fig. 4), not adapted to the capture of wood-boring insects.


Louis Agassiz Fuertes.

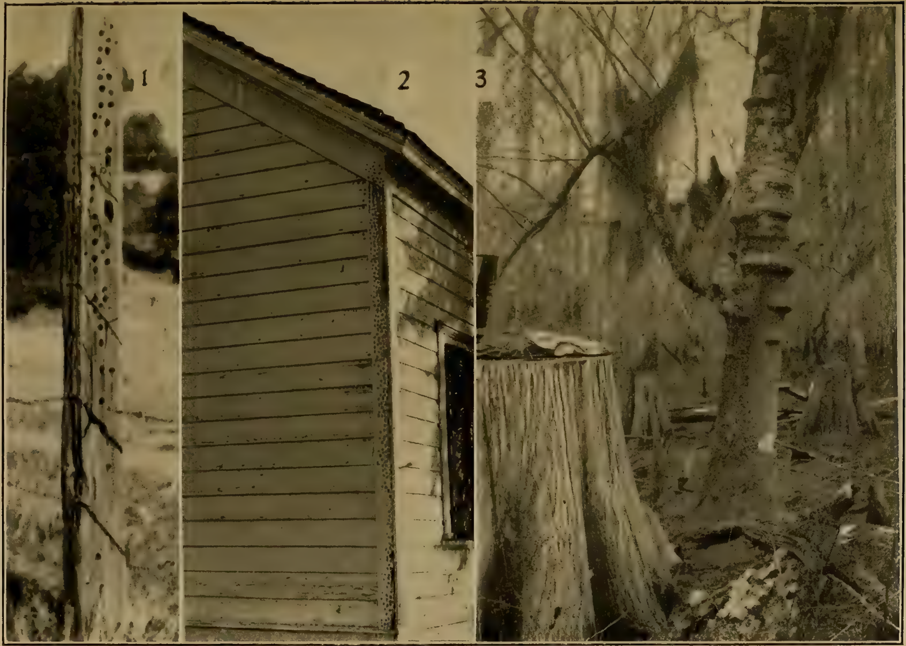
A Hoen & Co Baltimore

WILLIAMSON SAPSUCKER.
[Left figure, female; right, male.]



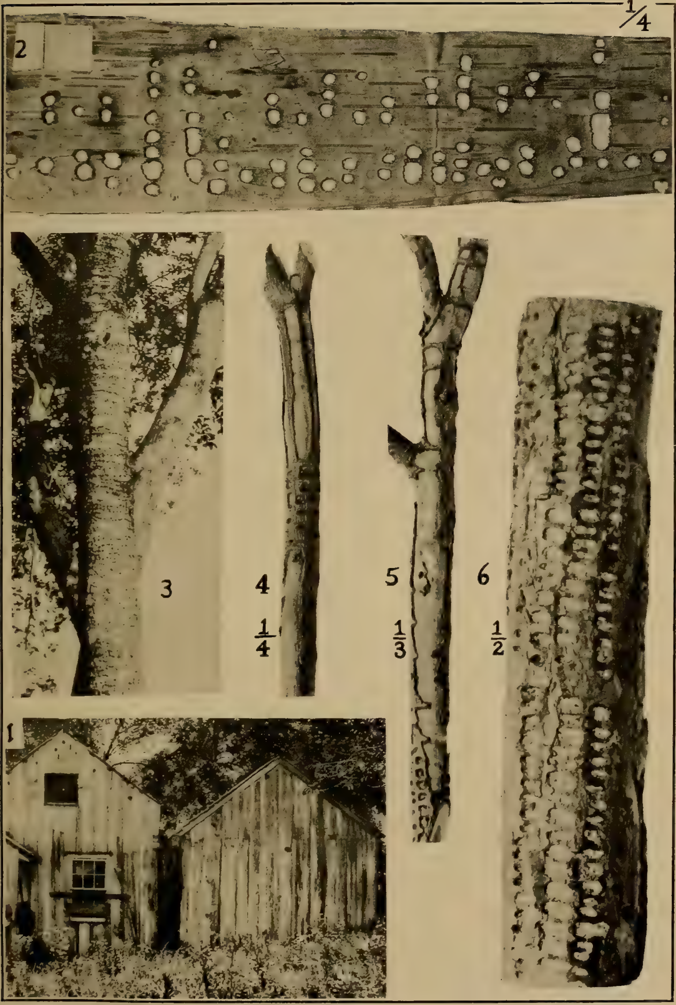
WORK OF PILEATED WOODPECKER; BLEACHED WALNUT WOOD.

[1, Hole made in canoe cedar (*Thuja plicata*) by pileated woodpecker in search of insects. 2, Healed excavation in same wood, outside view. 3, Same, inside view. 4 and 5, Excavations by pileated woodpecker in dead deciduous trees, Vilas County, Wis. By H. S. Barber. 6, Bleached streak in black walnut, caused by woodpecker's food excavation.]



WORK OF CALIFORNIA WOODPECKER; SWOLLEN SAPSUCKER GIRDLES.

[1, Storage holes of California woodpecker in fence post, Sierra foothills, California. 2, Schoolhouse, near Ukiah, Mendocino County, Cal. 3, Swollen girdles produced by sapsucker work on honey locust.]



WORK OF FLICKER AND SAPSUCKERS.

[1, Holes made by flicker in ranch buildings near Haywards, Cal. 2, Type of sapsucker work on white birch; 3, on apple; 4, on willow (*Salix cordata*), holes enlarged vertically by continued excavation at upper end; 5, on willow, almost complete barking; 6, on pitch pine, tree killed.]

In keeping with their peculiarities of structure, these brush-tongued woodpeckers have peculiar food habits. They are the true sapsucking and cambium-eating species. They girdle and kill many trees, either by destroying extensive areas of the cambium or more commonly by removing many small pieces in such a way as to sever most if not all the channels carrying the elaborated sap from which both wood and bark are formed.

The three species are probably equally to blame. While it has been asserted that the red-breasted and Williamson sapsuckers harm trees less than the yellow-bellied, these statements are probably founded on insufficient information. There is a dearth of data respecting the habits of these two woodpeckers, but similarity of structure and the evidence of stomach examinations indicate that the three species of sapsuckers are much alike in their cambium-eating habits and hence all three are injurious to trees. The Williamson sapsucker, however, is strictly an inhabitant of pine forests and aspen groves at considerable elevations, and therefore under present conditions is not likely to injure trees of great value to man.

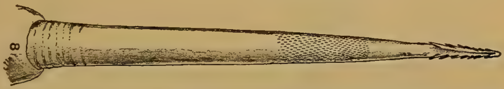


FIG. 3.—Spiny tongue of downy woodpecker (*Dryobates pubescens*). (From Lucas, Rept. U. S. Nat. Mus., 1895.)

Stomach examinations show that the red-breasted sapsucker consumes enough cambium and bast to average 12.16 per cent of its food. The same food constitutes 12.55 per cent of the stomach contents of the Williamson sapsuckers examined and 16.71 per cent of the yellow-bellied woodpecker's diet, an average amount for the three of 13.8 per cent. It must be noted also that cambium is a very delicate, perishable material, at certain times no more than a jelly, and thus never receives a percentage valuation in examinations of long-preserved stomachs corresponding to its bulk when first swallowed. Neither do we get any record of the sap consumed by these birds, and they are inordinate tipplers.[1] Hence the value of the percentages cited lies not so much in their accuracy as to the quantity of cambium eaten as in the fact that they indicate a steady consumption of this important substance. There

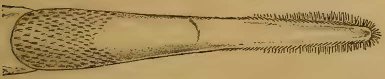


FIG. 4.—Brushy tongue of sapsucker (*Sphyrapicus varius*). (From Lucas, Rept. U. S. Nat. Mus., 1895.

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[1] A yellow-bellied sapsucker has been observed to remain within a yard of some of its holes in a maple tree, drinking the sap at frequent intervals, from 10 a. m. to 5 p. m.

is no doubt that cambium, bast, and sap are depended upon by sapsuckers as staple diet.

The results of sapsucker attacks on trees are so uniform and characteristic as to be distinguished easily from the work of other woodpeckers. Sapsucker holes are drilled clear through the bark and cambium and often into the wood. They vary in outline from circular to squarish elliptical, in the latter case usually having the longer diameter across the limb or trunk. Generally they are arranged in rings or partial rings around the trunk, but they often fall into vertical series. Deeply-cut holes arranged with such regularity are made only by sapsuckers.

After the original pattern of holes is completed, the sapsuckers often continue their work, taking out the bark between holes until sometimes large areas are cleanly removed. This often occurs on small limbs or trunks, where long strips of bark up and down the tree are removed, leaving narrow strings between. This effect is also produced by continually enlarging single punctures by excavating at the upper end (Pl. V, fig. 4), which is done to secure fresh inner bark and a constant supply of sap. Occasionally, after a tree has been checkered or grooved after the above-described systematic methods, it may be barked indiscriminately, leaving only ragged patches of bark. (Pl. V, fig. 5.) Even in such cases, however, traces of the regularly arranged punctures are likely to remain, and there is no difficulty in recognizing the work as that of sapsuckers, for no other woodpecker makes anything like it on sound, living trees.

All holes, grooves, or irregular openings made by sapsuckers penetrate at least to the outermost layer of sapwood or nongrowing part of the tree. This results in the removal of the exterior rough bark, the delicate inner bark or bast, and the cambium. Since the elaborated sap (upon which the growth of trees depends) is conveyed and stored in these layers, it is evident that sapsuckers attack the trees in a vital part. Each ring of punctures severs at its particular level part of the sap-carrying vessels, another ring made above destroys others, and so the process continues until in extreme cases circulation of elaborated sap stops and the tree dies. When the injury to the vital tissues is not carried so far, only a limb here and there may die, or the tree may only have its vitality lowered for a few years. If the attacks cease, it may completely recover.

EFFECTS OF SAPSUCKER WORK ON THE EXTERNAL APPEARANCE OF TREES.

Recovery, however, does not mean that the tree has escaped permanent injury. Patches of cambium of varying size may be killed. Growth ceases at these points and the dead and discolored areas are finally covered by wood and bark. Until this process is completed, the tree is disfigured by pits with dead bark and wood at the bottom, and even when completely healed, the spot remains a source of weakness. In fact, all sapsucker pecking is followed by more or less rotting and consequent weakening of the wood, and renders trees more liable to be broken by the wind or other causes.

Sapsucker injuries usually stimulate growth of the wood layers at the points attacked, so that they become much thicker than usual. This results in a slight swelling of the bark, and when the birds reopen the old wounds year after year, as they habitually do, succeeding wood layers make excess growth and in time shelflike girdles develop. On trees having thin, flexible, rapidly growing bark, the swollen girdles are smoothly covered and rounded (fig. 5; Pl. IV, fig. 3), but on trees having thick, brittle, or stiff bark, the bark breaks and a gaping furrow is formed at the summit of the swelling (Pl. VII, figs. 2 and 3; Pl. VIII, fig. 1; Pl. IX, fig. 2; Pl. X, fig. 1). Some trees are remarkably deformed by such protruding girdles (fig. 5.)

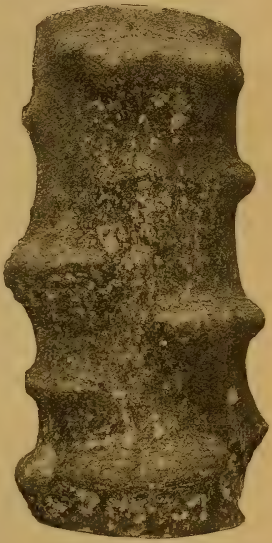

FIG. 5.—Sapsucker work on honey locust (*Gleditsia triacanthos*). Protruding girdles. Specimen is 18 inches in diameter.

Buds are apt to start from the edges of holes drilled by sapsuckers and form twigs or small branches. Such shoots have been noted on honey locusts and sycamores, and in some trees, such as willows and elms, which are prone to produce adventitious buds, they arise from sapsucker injuries in such numbers as to materially disfigure the trees.

The bark may be otherwise disfigured, as by exudations of gum or by pitch streams, or sapsucker injury may be followed by fungus attack, as in certain pines. Spores of *Peridermium cerebrum* sometimes reach the wood through sapsucker punctures and cause knotty gall-like outgrowths which greatly disfigure the trees.

The wood also is often distorted and discolored in such a way as to destroy its commercial value. This phase of damage by sapsuckers is exceedingly important and will be made the subject of a separate section of the bulletin.

EFFECTS OF SAPSUCKER WORK ON THE HEALTH OF TREES.

Bendire says: "In certain localities, as where apple orchards are abundant, it [the yellow-bellied sapsucker] becomes a nuisance, and materially injures and eventually kills many such trees."[1] In the State of Washington whole orchards of young apple trees have been destroyed by sapsuckers, either by the western form of the yellow-bellied woodpecker or by the red-breasted sapsucker. The latter species injures other trees also, as related by Ellwood Cooper, of Santa Barbara, Cal. He says:

> There were no trees killed outright at the time the sapsuckers were so bad, but many of them ceased to be useful as fruit bearers. Some apple trees died back at the top and did not thrive, so that I cut them down as useless, also a few English walnut trees. The orange trees had my special attention. I used the knife, cutting out the injured place, covered the wood with grafting wax, and had the bark heal over. The trees are living now and thriving. I have a few blue gums (*Eucalyptus globulus*) that show injury at this time. I consider the birds a pest. There were many other trees injured. I hired a boy to shoot the red-headed woodpeckers [i. e., the red-breasted sapsuckers] and intend to do so the coming spring. (Jan. 22 and Feb. 8, 1909.)

B. Horsford, of Springfield, Mass., writes as follows concerning the yellow-bellied sapsucker:

> I have seen the white birch cut off, or rather broken off, 20 feet from the ground in more cases than I can number—all his work. I have seen the yellow birch destroyed in the same manner—branches of the tree cut off, shriveled branches struggling for life, but dying. I have seen a tree girdled with spots 20 feet from the ground, then again a few feet lower, then below that, repeating the process to the roots, leaving a dead and dry section above each belt. I have seen the white pine destroyed in the same way. . . . I have seen an elm tree 18 inches in diameter, whose trunk of 12 feet was spotted with "gimlet holes" . . . where for 10 summers past I have shot the pest and thereby saved the tree. . . . Where the bird breeds, whole orchards are severely injured, if not destroyed. . . . The leaves fade and the fruit withers on the stem or falls to the ground. Perhaps not half the apple trees attacked are killed outright, but the birch tree invariably dies.[2]

Even forest trees are not immune from injury by sapsuckers. Prof. W. W. Cooke, of the Biological Survey, states that near Lake Itasca, in northern Minnesota, where the birds breed, the yellow-bellied is the most common woodpecker. It does much mischief among forest trees, killing many great poplars by its girdles.

Mr. A. W. Butler says:

> It knows when sugar making begins. . . . I have found their borings, from which sap was flowing, February 19, 1896. Through March and April they continue their work. . . . In fall when they come to us they resume their work of piercing the bark of maple, apple, and other trees. . . . I have found their fresh work on young apple trees, never before pierced, as late as November 19, 1895. Pine trees are also girdled, chiefly, however, through the winter, for among them the sapsucker spends his winter, and about lawns where pines and maples grow together they are most commonly found at that season. By spring they have removed most of the bark scales

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[1] Bendire, C., Life Histories of N. A. Birds, II, 84-85, 1895.

[2] Forest and Stream, XX, 124, 1883.

> from the pine, and it then appears quite clean. The resin flows from the wounds the bird has made and forms milky streaks and gummy excrescences later in the season, which look unsightly. . . . The pines are weakened, their tops girdled until they become bent and even blown off by the wind. Apple trees and choice maples are seriously damaged. . . . I have counted six of these birds at one time on a dozen sugar maples in front of one lot in my own town, and have seen the sap flow in a stream.[1]

Dr. P. R. Hoy gives evidence of damage by yellow-bellied sapsuckers. In 1865 he wrote as follows:

> They . . . energetically attack the maple, mountain ash, pine, spruce, pear, apple, plum, cherry, peach, and silver poplar, . . . ironwood, wild cherry, and basswood. . . . It is during the autumnal visit that they do the greatest damage; for in spring, when the vital forces of vegetation are unusually active, the tree recovers more certainly from the wounds inflicted, while in the fall, vegetable life being less active, the septa between the punctures are more likely to dry, leaving the tree dead or crippled for life. The sapsuckers attack the most thrifty trees, but after they have suffered a siege from these sapsuckers, they are thrifty no more. If not killed, they are so stunted that they fall an easy prey to the bark lice, . . . for when an orchard tree is enfeebled from any cause, bark lice are sure to finish the work. . . . The damage done by these birds to orchards and ornamental grounds is considerable, second only to that of the bark louse. There is not a garden or orchard of any size in the vicinity of Racine [Wis.] that has not lost trees killed by the sapsucker.[2]

The instances above cited are sufficient to show that sapsuckers materially injure or even kill many trees of a wide variety of species. Subjoined are lists of the trees attacked by the three species of sapsuckers as complete as present information permits.

TREES ATTACKED BY THE YELLOW-BELLIED SAPSUCKER.

(*Sphyrapicus varius.*)

In these lists field notes on damage to certain trees are given, with locality and name of observer. The writer is responsible for citations with localities only (most of which are vouched for by specimens in the Biological Survey), for unsigned field notes, and for records of specimens in museums. The following abbreviations are used: A. A., Arnold Arboretum; A. M., American Museum of Natural History; F., Field Museum of Natural History; H., Hopkins collection. These symbols are accompanied by the numbers of the specimens in these wood collections. Notes from published sources are followed by the name of the author, and the bibliography following the lists supplies the complete references. The exception is a paper read by Dr. A. D. Hopkins before the Biological Society of Washington, which, although unpublished, is inserted in the bibliography. We are under the greatest obligations to Dr. Hopkins, who has furnished a vast amount of valuable data on sapsucker work. The scientific names of the trees agree in the main with those of Britton's North American Trees.[3]

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[1] Indiana Dept. Geol., Annual Report 22 (for 1897). pp. 835–6, 1898.

[2] Trans. Ill. State Agr. Soc., V, 731–2, 1865.

[3] Britton, N. L., New York, 1908, pp. 894.

Names of families and the statistics as to the number of species in them are from the same book.

Included in this list are the names of many trees attacked by sapsuckers, but by which of the three species is not known. In view of the immense range of the yellow-bellied sapsucker, probably all these trees are at some time or other punctured by this species. Many of them are undoubtedly attacked by one of the other species, especially in the West by the red-breasted sapsucker.

The information concerning sapsucker attack on trees of various families is summarized for each family before presenting the evidence relating to the individual species. Following the family summaries are lists of all the species attacked, with detailed accounts of the species notably injured.

The yellow-bellied sapsucker, in addition to attacking trees, also works upon several vines. Sometimes a vine is riddled while the tree which supports it is untouched. The vines upon which punctures have been noted are:

DUTCHMAN'S PIPE (*Aristolochia macrophylla*).—West Virginia (F.), Abbeville, La.

POISON IVY (*Rhus toxicodendron*).—This vine is abundantly punctured by sapsuckers and sometimes partly or entirely killed, as at Longbridge, La.

RATTAN VINE (*Berchemia volubilis*).—Abbeville, La.

FROST GRAPE (*Vitis vulpina*).—Longbridge and Abbeville, La.

VIRGINIA CREEPER (*Psedera quinquefolia*).—Plummers Island, Md.

TRUMPET CREEPER (*Tecoma radicans*).—Cottonport and Abbeville, La.

These 6 species of vines belong to 5 families, 2 of which are not otherwise represented in the list.

THE MAIDENHAIR TREES (GINKGOACEÆ).

This family contains only a single species, a native of Japan, which is commonly cultivated for ornament in the United States. It is vigorously attacked by sapsuckers, but so far as known it is not materially defaced.

MAIDENHAIR TREE (*Ginkgo biloba*).—Along the central avenue of the Agricultural Department grounds in Washington are 76 trees of this species, of which 29, or 38 per cent, have been pecked by the yellow-bellied sapsucker. Some of the trees show numerous punctures, and in a few cases swollen girdles have resulted. One tree which divides into ten main trunks is closely punctured all over. The trees are disfigured, but as they are not especially prized for beauty of trunk, the blemishes are not serious.

THE YEW FAMILY (TAXACEÆ).

Four arborescent species of this family occur in the United States, and three of them are known to be attacked by sapsuckers. These trees are little used for ornament, and as yet we have no evidence that sapsucker attacks have weakened or killed any of them.

LIST OF TAXACEÆ ATTACKED.

Florida yew (*Taxus floridana*).—Bristol, Fla. (A. A. and A. M. 411).

Stinking cedar (*Tumion taxifolium*).—River Junction, Fla. (A. A. and A. M. 414.)

California nutmeg (*Tumion californicum*).—California (A. A. and A. M. 413).

THE CONE-BEARING TREES (PINACEÆ).

This large and important family of trees includes many of the finest ornamental forms. Almost half of the total number of native species, as well as several introduced forms, are known to be attacked by sapsuckers. The following table shows the number of indigenous species in each genus of the family and the number subject to attack by sapsuckers. There is little doubt that all are punctured at times.

Pinaceæ attacked by sapsuckers.

Genus.	Number of native species.	Number of these attacked.	Introduced species attacked.
Pine (*Pinus*)	36	16	2
Larch (*Larix*)	3	0	1
Spruce (*Picea*)	8	3	1
Hemlock (*Tsuga*)	4	3	0
Fir (*Pseudotsuga*)	2	1	0
Fir (*Abies*)	10	5	0
Redwood (*Sequoia*)	2	2	0
Bald cypress (*Taxodium*)	2	1	0
Incense cedar (*Heyderia*)	1	1	0
Arbor vitæ (*Thuja*)	2	1	0
Cypress (*Cupressus*)	5	3	0
Cedar (*Chamaecyparis*)	3	1	0
Juniper (*Juniperus*)	12	5	0
	90	42	4

Several of the species attacked are known to have been seriously injured or killed, including 6 native and 2 introduced pines, 2 native and 1 introduced spruce, 2 native hemlocks, 2 firs, and 1 juniper.

For Butler's testimony concerning injuries to pines see pages 20–21. Steere makes a more serious charge, saying the bird "injures and oftentimes kills the pines, making so many holes that the trees bleed to death" (Annapolis, Md., Aug. 24, 1885).

Spruces, if not killed, are weakened and rendered unsightly. Wright says:

> Here, in the garden, they attacked a large spruce one autumn, and the next spring the trunk was white with the sap that leaked from the hundreds of "taps," and the tree has never since recovered its vitality.

Among the coniferous trees so badly affected are the most beautiful and valuable ornamental species, defacement or destruction of which is a serious offense.

LIST OF PINACEÆ ATTACKED.

White pine (*Pinus strobus*).—The white pine is the most important tree of the eastern United States and is a valuable ornamental species. Hopkins states that young trees are injured or killed by sapsuckers; Horsford notes that he has "seen the white pine destroyed" by these birds; and Warren says: "In one garden [in Racine, Wis.] all the . . . white pine trees were entirely killed." Evidently this species suffers severely from sapsuckers, and, as it is so valuable, the loss is serious.

Limber pine (*Pinus flexilis*).—Colorado (A. M. 499).

Whitebark pine (*Pinus albicaulis*).—Washington (A. M. 498).

One-leaved nut pine (*Pinus monophylla*).—California (A. A. and A. M. 492).

Nut pine (*Pinus edulis*).—Vermejo, N. Mex., May 6, 1903, (H.).

Chihuahua pine (*Pinus chihuahuana*).—Southern Arizona (A. M. 491).

Red pine (*Pinus resinosa*).—This species is rather infrequently used for ornamental purposes and generally goes under the name Norway pine. Butler (1890) says: "Norway pines in my yard have been girdled until they became puny, sickly trees and were cut down, and one tree was so girdled about two-thirds of its height from the ground that it was broken off during a windstorm." A red pine in the grounds of the Smithsonian Institution at Washington bears considerable sapsucker work.

Bull pine (*Pinus ponderosa mayriana*).—Santa Rita Mountains, Ariz. (A. M. 489).

Lodgepole pine (*Pinus murrayana*).—Uintah Mountains, Medicine Bow Range, Wyo. and Utah (H. 6175b).

Long-leaf pine (*Pinus palustris*).—At the Santee Club, South Carolina, fully 50 per cent of the long-leaf pines bear sapsucker work, some to a disfiguring degree, as protruding girdles have resulted. At Gainesville, Fla., sapsucker pecking is also plentiful on this species, but on St. Vincent Island, Fla., only a few trees are punctured. Hopkins notes that the sapsucker injures or kills young trees. (His specimens are from Baldwin, Fla.; Boardman, N. C.; and Buna, Tex.) Ernest Napier, of the Game Commission of New

Jersey, states that many young trees of this species in Lee County, Fla., have been killed by sapsuckers. The long-leaf pine is attacked throughout its range.

PITCH PINE (*Pinus rigida*).—Many trees of this species in the vicinity of Washington, D. C., show abundant evidence of sapsucker attack. A specimen from Delslow, W. Va. (H. 6653), is from a tree which was killed by yellow-bellied sapsuckers (Pl. V, fig. 6). The sapsucker pecks are in vertical rows and are so numerous and closely placed that nearly half the bark is removed. Pitch pines in Rockfish Valley, Va., also are attacked.

POND PINE (*Pinus serotina*).—Santee Club, South Carolina.

SHORT-LEAF PINE (*Pinus echinata*).—Hopkins states that young trees are injured or killed by sapsuckers. Specimens collected near Seven Locks, Montgomery County, Md., show that sapsucker injuries are sometimes followed by an attack of the fungus *Peridermium cerebrum*, causing large gall-like outgrowths which greatly disfigure the trees.

SPRUCE PINE (*Pinus glabra*).—Santee River, S. C. (A. M. 472).

SCRUB PINE (*Pinus virginiana*).—The statement regarding fungus attack in *echinata* applies also to this species, which we know to be punctured by sapsuckers at Morgantown, W. Va. (H.), and in the vicinity of the District of Columbia. A dead tree on Plummers Island, Md., showed a band 8 to 10 inches wide of closely set punctures, and in other parts of the tree vertical strips of the bark had been removed. Death may well have been due to the sapsucker injuries.

TABLE-MOUNTAIN PINE (*Pinus pungens*).—Fairfax County, Va.

AUSTRIAN PINE (*Pinus laricio austriaca*).—This species is widely used for ornamental planting in the United States. It is often disfigured or even killed by the yellow-bellied sapsucker. Widmann (see Bendire) says it is the bird's "favorite tree among our ornamental evergreens. . . . The exudations of resin, the secondary result of the sapsucker's labors, mar the appearance of the trees by running down their sides or hardening into unsightly lumps." Clifford states that the sapsuckers "do great damage to the . . . Austrian pines, sometimes girdling them so as to kill them," and Purdy notes that this species is one of the sapsucker's preferred food trees. An Austrian pine in the Department of Agriculture grounds bears considerable sapsucker work. Some of the pits are exceptionally large, and many are arranged in vertical rows. Dr. A. K. Fisher says that one of 7 or 8 Austrian pines at his old home in Ossining, N. Y., was favored by sapsuckers and worked upon extensively every fall.

SCOTCH PINE (*Pinus sylvestris*).—This tree is occasionally planted for ornament and suffers from sapsuckers almost as severely as the Austrian pine. Widmann (see Bendire) says the Scotch pine is the bird's second choice among our ornamental evergreens. The trunks and larger limbs . . . look very badly at times." Purdy notes that the Scotch pine is a favorite with the sapsuckers, and Clifford states that the birds sometimes kill it.

EUROPEAN LARCH (*Larix decidua*).—Massachusetts, Kennard.

NORWAY SPRUCE (*Picea excelsa*).—This tree is extensively planted for ornamental purposes. According to Elliott, the sapsucker "in its fondness for cambium often removes considerable fresh bark. I have seen several fine Norway spruces ruined in this way."

RED SPRUCE (*Picea rubens*).—Randolph County, W. Va. (F. 74878); Davis, W. Va. (H. 6626b).

ENGELMANN SPRUCE (*Picea engelmanni*).—Sandpoint, Idaho (H. 195a).

WEEPING SPRUCE (*Picea breweriana*).—Northern California (A. M. 457).

TIDELAND SPRUCE (*Picea sitchensis*).—Push, Oreg. (H. 121a).

EASTERN HEMLOCK (*Tsuga canadensis*).—This graceful and stately tree, a gem among ornamental conifers, is not spared by sapsuckers. Allen says: "In Vermont where I have observed *S. varius* [the yellow-bellied sapsucker] in abundance, no trees were so extensively perforated as the hemlock." Bendire says the sapsucker "is partial to the . . . hemlock;" and Hopkins notes that the bird injures or kills young trees. (Specimens from Allegheny Mountains, W. Va.)

SOUTHERN HEMLOCK (*Tsuga caroliniana*).—South Carolina (A. M. 454); Habersham County, Ga., December 18, 1909 (F.).

WESTERN HEMLOCK (*Tsuga heterophylla*).—Detroit, Oreg., June 2, 1899 (H.); Hoquiam, Wash. (H. 2167a) (see Pl. VIII, fig. 3).

DOUGLAS FIR (*Pseudotsuga mucronata*).—St. Helena, Oreg. (H. 116a).

WHITE FIR (*Abies concolor*).—Oregon (A. M. 444); San Bernardino Mountains, Cal. Grinnell.

WHITE FIR (*Abies grandis*).—Oregon (A. M. 446); McCloud, Cal. (H. 21).

WHITE FIR (*Abies amabilis*).—Oregon (A. M. 447).

RED FIR (*Abies magnifica*).—California (A. M. 441).

RED FIR (*Abies nobilis*).—Oregon (A. M. 442).

BIG TREE (*Sequoia washingtoniana*).—Near Grant National Park, Cal. (A. A. and A. M., 438).

REDWOOD (*Sequoia sempervirens*).—Eureka, Cal. (H.).

BALD CYPRESS (*Taxodium distichum*).—Boardman, N. C., March 25 and April 3, 1904 (H.); Cottonport, La., Longbridge, La.

INCENSE CEDAR (*Heyderia decurrens*).—Oregon (H.).

CANOE CEDAR (*Thuja plicata*).—Washington, May 3, 1899 (H.).

MONTEREY CYPRESS (*Cupressus macrocarpa*).—Monterey, Cal. (A. M. 432).

GOWEN CYPRESS (*Cupressus goveniana*).—California (A. M., 430).

MACNAB CYPRESS (*Cupressus macnabiana*).—Lake County, Cal. (A. M. 429).

WHITE CEDAR (*Chamæcyparis thyoides*).—Dismal Swamp, Va. November 21, 1901 (H.); Atsion, N. J. (A. M. 428).

DESERT JUNIPER (*Juniperus utahensis*).—Utah (A. A. and A. M. 422).

WESTERN JUNIPER (*Juniperus occidentalis*).—California (A. M. 420).

ROCK CEDAR (*Juniperus mexicana*).—Austin, Tex. (A. M. 418.)

NORTHERN RED CEDAR (*Juniperus virginiana*).—This species is commonly attacked by sapsuckers. Mr. J. M. Thompson states that it is one of the bird's principal food trees, and Mr. F. K. Steere says it is often badly hurt by the sapsucker (letter from Annapolis, Md., Aug. 24, 1885). Of 40 red cedar trees on a part of Plummers Island, Md., 19 are covered with closely set sapsucker punctures. Specimens from Florida (A. M. 417); Kanawha Station, W. Va. September 28, 1903 (H.); and Illinois (F. 26487) show abundant sapsucker work.

SOUTHERN RED CEDAR (*Juniperus barbadensis*).—Jacksonville, Fla. (A. M. 416).

THE POPLARS AND WILLOWS (SALICACEÆ).

There are 15 native species of poplar in the United States, 8 of which, besides 1 introduced tree, are known to be attacked by sapsuckers. The only instance of serious injury to poplars that has come to notice was communicated verbally by Prof. Cooke of the Biological Survey. He states that in northern Minnesota, where the yellow-bellied sapsucker is common in summer, it kills many large poplar trees in the forests.

Willows are often seriously injured. Hopkins says the sapsucker injures or kills young trees, and specimens of small willows (Pl. V, fig. 5) collected by him in the Black Hills, S. Dak., September 3, 1901, show almost complete barking. Grinnell reports that sapsuckers kill many white willows (*Salix lasiolepis*). Fifteen of the 26 native arborescent willows are known to be attacked.

The injury to willows and poplars by sapsuckers is unfortunate, since these trees are valuable for shade, for ornament, and forprotecting the banks of water courses.

LIST OF SALICACEÆ ATTACKED.

SILVER POPLAR (*Populus alba*).—Washington, D. C., April 26, 1903 (H.); Albany, N. Y., Hough; Racine, Wis., Hoy, 1865.

SWAMP POPLAR (*Populus heterophylla*).—Louisiana or Alabama (A. A. and A. M. 378).

Black cottonwood (*Populus trichocarpa*).—Seattle, Wash. (A. A. and A. M. 373).

Balm of Gilead (*Populus candicans*).—New Hampshire (A. A. and A. M. 377).

Cottonwood (*Populus acuminata*).—Nebraska (A. M. 374).

Tacmahac (*Populus balsamifera*).—Essex County, N. Y. (A. A. and A. M. 376); Lewis County, N. Y. (Hough).

Carolina poplar (*Populus deltoides*).—Texas (A. M. 372); Venice, La.

Aspen (*Populus grandidentata*).—Rawdon, Nova Scotia (A. M. 379).

Aspen (*Populus tremuloides*).—Mackenzie Valley, Canada (E. A. Preble).

Black willow (*Salix nigra*).—Belle Isle, La.

Ward willow (*Salix longipes*).—St. Louis, Mo. (A. A. and A. M. 368).

California black willow (*Salix lævigata*).—California (A. A. and A. M. 366).

Willow (*Salix toumeyi*).—Santa Catalina Mountains, Ariz. (A. A. and A. M. 365).

Peach-leaved willow (*Salix amygdaloides*).—New Mexico (A. A. and A. M. 367).

Western black willow (*Salix lasiandra*).—California (A. A. and A. M. 362 and A. M. 364).

Sandbar willow (*Salix interior*).—New Orleans, La. (A. M. 360).

Silver-leaved willow (*Salix sessilifolia*).—California (A. A. and A. M. 359).

Willow (*Salix missouriensis*).—Furness, Nebr. (A. M. 356).

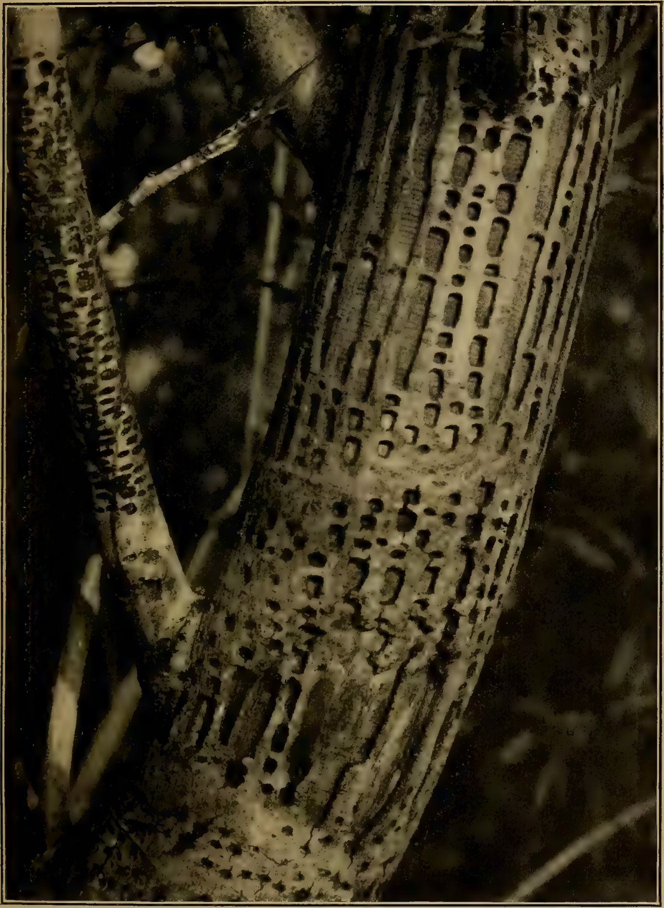
White willow (*Salix lasiolepis*).—California (A. A. and A. M. 357). According to Britton, the name *Salix bigelovii* is a synonym of *S. lasiolepis*. Hence the following note is incorporated here (see Pl. VI):

> Near Bluff Lake [Cal.] a species of willow (*Salix bigelovii*) grows in good-sized clumps . . . and these willows seem to offer special attraction to the sapsuckers. But curiously enough the attentions of the birds are confined to a single clump in a locality. . . . The incisions in the bark were generally rectangular, the long axis horizontal, and in vertical rows. These up-and-down rows of incisions often ran together, making vertical grooves, and sometimes also the rows were so close together as to obliterate the interval, so that the bark was completely gone over a considerable space The trunk above this zone of attack was always partly or entirely dead. . . . This single willow clump . . . was rendered conspicuous by all its upper branches and stalks, above 2 to 4 feet from the ground, being dead, with the bark weathered off and the stems left bare and shining. (Grinnell, 1908.)

Willow (*Salix hookeriana*).—Oregon (A. A. and A. M. 353).

Yew-leaved willow (*Salix taxifolia*).—Swisshelm Mountains, Ariz. (A. A. and A. M. 358 and A. M. 361).

Satin willow (*Salix sitchensis*).—California (A. A. and A. M. 352).



WORK OF SAPSUCKER ON WILLOW.

[Sierra sapsucker (*Sphyrapicus v. daggetti*) at Bluff Lake, California, September 3, 1905. By J. Grinnell.]

Glaucous willow (*Salix discolor*).—Vermont (A. A. and A. M. 355).

Willow (*Salix scouleriana*).—Oregon (A. A. and A. M. 354).

THE BAYBERRIES (MYRICACEÆ).

There are four arborescent species[1] of this family in the United States, of which three are known to be attacked by sapsuckers, one at least being sometimes in part or entirely killed. However, these small trees have slight economic value and are little used for ornamental planting.

LIST OF MYRICACEÆ ATTACKED.

Bayberry (*Myrica carolinensis*).—Church Island, N. C.

Wax myrtle (*Myrica cerifera*).—Florida (A. M. 384); Santee Club, South Carolina.

California bayberry (*Myrica californica*).—California (A. M. 382).

THE WALNUTS AND HICKORIES (JUGLANDACEÆ).

Sapsuckers are known to attack 3 of the 5 native species of walnut besides 1 introduced species, and 11 of the 14 native hickories. Throughout their range hickory trees usually are severely attacked by sapsuckers. We know of but one hickory being killed, but they are often disfigured by swollen girdles. Sapsuckers cause much staining and distortion in the wood of hickories.

LIST OF JUGLANDACEÆ ATTACKED.

Butternut (*Juglans cinerea*).—Fairfax County, Va.

Black walnut (*Juglans nigra*).—Allenton, Mo. (A. M. 399); Indianapolis, Ind. (H. 24236); Rockfish Valley, Va.; Beltsville, Md.

Texan walnut (*Juglans rupestris*).—Arizona (A. A. and A. M. 398).

English walnut (*Juglans regia*).—A tree on the grounds of the Department of Agriculture in Washington bears profuse evidence of sapsucker work. One limb has been killed on one side.

Nutmeg hickory (*Hicoria myristicæformis*).—Oakley, S. C. (A. M. 392).

Pecan (*Hicoria pecan*).—Butler County, Mo. (F. 72458); Illinois (F. 26454); Allenton, Mo. (A. A. and A. M. 395); Pantherburn, Miss.; Department of Agriculture grounds, District of Columbia.

Texan pecan (*Hicoria texana*).—Columbia, Tex. (A. A. 394).

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[1] Only 3 arborescent species are mentioned in Britton's North American Trees, but *Myrica carolinensis* Miller (= *Myrica cerifera intermedia* Chapman, fide Sudworth) is typically tree-like on the shores of Currituck Sound, N. C.

Bitter pecan (*Hicoria aquatica*).—Southern Arkansas (A. A. and A. M. 391); Cottonport and Longbridge, La.

Bitter nut (*Hicoria cordiformis*).—West Virginia (F. 73488); Allenton, Mo. (A. A. and A. M. 393); Seven Locks, Montgomery County, Md.; Department of Agriculture grounds, District of Columbia.

Mocker nut (*Hicoria alba*).—This species is very commonly attacked by sapsuckers. A tree in Fairfax County, Va., examined March 21, 1909, bore many protruding girdles (Pl. X, fig. 1) where the birds had pecked in the same place year after year, besides a great deal of less conspicuous work. Plate IX, figure 2, shows similar girdles on another tree which is fully 2 feet in diameter. At the date specified there were many fresh drills in the girdles and elsewhere, and sap was flowing freely. Evidently growth is vigorous in this species, as a plug of wood grows out through almost every hole in the bark. About all the sapsucker has to do when he visits the tree the next year is to knock out the plugs. However, he usually punctures a layer or two of sapwood to insure a good flow of sap. A dead tree of this species near the same locality was evidently killed by sapsuckers. It bore more than a hundred nearly or entirely complete girdles of holes, besides numerous less perfect ones. In fact it was riddled from bottom to top. (Pl. IX, fig. 3.) From an examination of sections of this tree it was learned that all this work has been done in five years or less. Much of it never healed. The mocker nut is severely attacked in the vicinity of Cloverdale, Ind. (letter from J. B. Burris, Dec. 9, 1901), and to some extent also in Illinois (F. 26457).

Big shellbark (*Hicoria laciniosa*).—Morgantown, W. Va. (H.); Illinois (F. 26458); Department of Agriculture grounds, District of Columbia.

Shellbark (*Hicoria ovata*).—Widmann (see Bendire) notes that this species is "occasionally punctured." A specimen from Butler County, Mo., shows many pecks (F. 72449), and a tree in the Agriculture Department grounds at Washington has on the limbs many sapsucker girdles, which cause the bark to split and peel off more than it naturally would.

Southern shellbark (*Hicoria carolinæ-septentrionalis*).—Rome, Ga. (A. M.).

Pignut (*Hicoria glabra*).—Weed and Dearborn state that sapsuckers "puncture the pignut hickory," and C. G. Bates says:

> Bird pecks are common almost everywhere that hickories are found, but perhaps nowhere is the damage so serious as on the southerly slopes of the Cumberland Mountains of Tennessee, where the hickory, mostly pignut, occurs in rather open stands with chestnut oak, which is also frequently attacked by the sapsucker. (Dec. 15, 1908.)

Specimens from Butler County, Mo. (F. 72438), and Abbeville, La., show profuse sapsucker work, including large swollen girdles. A tree only an inch in diameter, on Plummers Island, Md., had been attacked by sapsuckers.

Woolly pignut (*Hicoria villosa*).—Huntsville, Ala. (A. A. and A. M. 385).

THE HORNBEAMS, BIRCHES, AND ALDERS (BETULACEÆ).

Ten of the 26 native arborescent species of this family, besides 1 introduced tree, are known to be attacked by sapsuckers. They are tabulated by genera below:

Genus.	Number of native species.	Native species attacked.	Introduced species attacked.
Hornbeams (*Carpinus*)	1	1	1
Hop hornbeams (*Ostrya*)	2	2	0
Hazelnuts (*Corylus*)	1	0	0
Birches (*Betula*)	14	5	0
Alders (*Alnus*)	8	2	0
	26	10	1

Two of the hornbeams and two hop hornbeams are much disfigured by sapsuckers, and at least two species of birches are frequently killed. Trees like the hornbeams with smooth close bark, and birches, which are prized for the beauty of their silvery white trunks, lose much of their ornamental value when disfigured by abundant sapsucker puncturing. Birches in particular are among the most valuable ornamental trees, and the fact that they are often killed by sapsuckers weighs heavily against the birds.

LIST OF BETULACEÆ ATTACKED.

Hornbeam (*Carpinus caroliniana*).—This tree when attacked is generally severely blemished (fig. 6). One in the Agricultural Department grounds is disfigured by a great many girdles, some of which are considerably swollen. In the vicinity of Gainesville, Fla., hornbeams are plentifully punctured, and at Abbeville, La., most of the hornbeams in the woods bore abundant sapsucker work. Specimens examined from Illinois (F. 26482), Morgantown, W. Va. (H.), and southern Arkansas (A. A. 351) are profusely punctured.

European hornbeam (*Carpinus betula*).—Department of Agriculture grounds, District of Columbia.

Hop hornbeam (*Ostrya virginiana*).—Morgantown, W. Va. (H.); Massachusetts (A. A. and A. M. 350).

Hop hornbeam (*Ostrya knowltoni*).—Talfrey, Ariz. (A. A. and A. M. 349).

GRAY BIRCH (*Betula populifolia*).—Department of Agriculture grounds, District of Columbia.

WHITE OR CANOE BIRCH (*Betula alba*).—This tree is frequently and seriously injured by sapsuckers (Pl. V, fig. 2). Weed and Dearborn say that "hundreds of punctures" are "made in white birches" and Hopkins notes that the sapsucker injures or kills young trees. Bolles, in writing of a sapsucker "orchard," states that "The tree in use last year was nearly dead. Two neighboring birches showing scars of earlier years were quite dead. . . . Orchard No. 4 . . . consisted of a large number of dead and a few living trees. . . . The part of the orchard in use was a birch, from whose roots rose 4 major trunks quickly subdividing into 15 minor stems each rising to a height of over 30 feet. All of the 15 trunks were dead or dying. Only 7 of them bore leaves." "Hermit," speaking of a sapsucker "orchard," says: "The . . . canoe birches were dead or dying. Many . . . had been broken off by the wind just below the belt of punctures." Horsford says: "I have seen the white birch cut off, or rather broken off, 20 feet from the ground, in more cases than I can number, all his work. . . . The birch tree invariably dies." And Garfield notes that "This bird invariably attacks what appears to be perfectly sound and healthy bark. Great injury is inflicted by these attacks. . . . The white birch is frequently killed." George H. Selover writes that sapsuckers have often killed silver birches at Lake City, Minn. (letter, 1885). The tree is attacked in Maine also (H.).

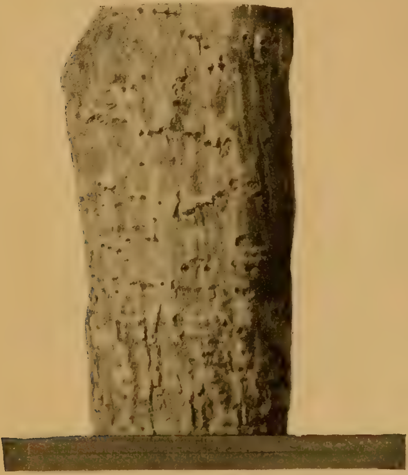


FIG. 6.—Sapsucker work on hornbeam (*Carpinus caroliniana*).

WHITE BIRCH (*Betula pendula*).—Department of Agriculture grounds, District of Columbia.

CHERRY BIRCH (*Betula lenta*).—West Virginia (H.).

YELLOW BIRCH (*Betula lutea*).—The sapsucker "is partial to the . . . yellow birch" (Bendire), and it "injures or kills young trees" (Hopkins). William Brewster says that the yellow birch is very commonly attacked in western Maine, and Horsford states: "I have seen the yellow birch destroyed . . . branches of the tree cut off, shriveled branches struggling for life, but dying."

ALDER (*Alnus incana*).—A. A. 340; western Maine, William Brewster.

WHITE ALDER (*Alnus rhombifolia*).—San Bernardino Mountains, Cal., Grinnell.

THE BEECHES, CHESTNUTS, AND OAKS (FAGACEÆ).

Thirty-four of the 68 native arborescent species of this important family of trees and 2 introduced forms are known to be attacked by sapsuckers. Usually the injury does not seem to affect the vigor of oaks, and we know of few instances of the external appearance of the trees being altered for the worse. A sample of a dying live oak, sent to the Bureau of Entomology from Glen Rose, Tex., shows no injury except by sapsuckers, and Bolles implies that red oaks are sometimes killed. On the whole, the evidence at hand, while showing that a large number of species of this family are attacked by sapsuckers, does not indicate serious injury to their appearance or health.

LIST OF FAGACEÆ ATTACKED.

BEECH (*Fagus grandifolia*).—Morgantown, W. Va. (H.); Rawdon, Nova Scotia (A. A. and A. M. 334); Massachusetts, Weed and Dearborn.

CHINQUAPIN (*Castanea pumila*).—Southern Arkansas (A. A. and A. M. 332).

CHESTNUT (*Castanea dentata*).—Pickens, W. Va. (H. 6687a); Townsend Center, Mass. (A. M. 333); Montgomery County, Md.; Afton and Rockfish Valley, Va.

TANBARK OAK (*Pasania densiflora*).—Hopkins.

RED OAK (*Quercus rubra*).—Bendire remarks that sapsuckers are "partial to the . . . red oak," and Bolles says it is "drilled for successive years," adding that "the forest trees attacked by them generally die." Five red oaks in the Department of Agriculture grounds show sparing sapsucker work; many trees about Afton, Va., are attacked, and a specimen from Allenton, Mo., shows that the tree is visited there also (A. M. 329).

PIN OAK (*Quercus palustris*).—Every tree of this species over a considerable area in the vicinity of Dead Run Swamp, Fairfax County, Va., bears profuse marks of sapsucker attack.

TURKEY OAK (*Quercus catesbæi*).—Florida (A. M. 322).

BLACK OAK (*Quercus velutina*).—Abbeville, La.

TEXAS OAK (*Quercus texana*).—Abbeville, La.

Scarlet oak (*Quercus coccinea*).—Department of Agriculture grounds, District of Columbia.

Spanish oak (*Quercus triloba*).—Florida (A. M. 321).

Swamp Spanish oak (*Quercus pagodæfolia*).—Abbeville, La.

Water oak (*Quercus nigra*).—Illinois (F. 26474); Santee Club, South Carolina.

Willow oak (*Quercus phellos*).—Missouri (A. M. 317); Depart-of Agriculture grounds, District of Columbia.

Laurel oak (*Quercus laurifolia*).—Abbeville, La.

Shingle oak (*Quercus imbricaria*).—Missouri (A. M. 313); Department of Agriculture grounds, District of Columbia.

White-leaf oak (*Quercus hypoleuca*).—Southern Arizona (A. M. 308).

California live oak (*Quercus agrifolia*).—Newhall, Cal. (A. M. 312).

White live oak (*Quercus chrysolepis*).—California (A. A. and and A. M. 306).

Live oak (*Quercus virginiana*).—Fully 90 per cent of the live oaks at the Santee Club, South Carolina, are abundantly pecked, some having protruding girdles. At Gainesville, Fla., a large proportion of the live oaks are punctured, generally profusely, while on St. Vincent Island, Fla., though many trees are pecked, the work is usually scanty. A specimen from Glen Rose, Tex. (presented by Dr. Hopkins, October 4, 1909), is rather closely punctured.

Net-leaf oak (*Quercus reticulata*).—Southern Arizona (A. A. and A. M. 285).

Texan white oak (*Quercus breviloba*).—Austin, Tex. (A. A. and A. M. 292).

Shin oak (*Quercus undulata*).—Arizona (A. M. 291).

Toumey oak (*Quercus toumeyi*).—Mule Mountains, Ariz. (A. M. 286).

Chapman oak (*Quercus chapmani*).—Apalachicola, Fla. (A. A. and A. M. 299).

Chestnut oak (*Quercus prinus*).—A sapling near the Seven Locks, Montgomery County, Md., shows considerable sapsucker work, which deforms its trunk. In the Cumberland Mountains of Tennessee this species is frequently attacked (C. G. Bates, Dec. 15, 1908), and a specimen in the Field Museum (No. 72968) shows that it is worked on vigorously in West Virginia.

Cow oak (*Quercus michauxii*).—Many trees of this species are abundantly punctured, frequently with unusually large holes (made necessary by the thickness of the bark) in the vicinity of Longbridge, Cottonport, and Abbeville, La.

Swamp white oak (*Quercus bicolor*).—Missouri (A. A. 296); Department of Agriculture grounds, District of Columbia.

Overcup oak (*Quercus lyrata*).—Southern Arkansas (A. M. 297); Illinois (F. 26519); Butler County, Mo. (F. 72988); Department of Agriculture grounds, District of Columbia.

California white oak (*Quercus lobata*).—California (A. M. 303).

Western white oak (*Quercus garryana*).—Grant Pass, Oreg., April 25, 1899 (H.); California (A. M. 302).

Colorado white oak (*Quercus leptophylla*).—Colorado (A. A. and A. M. 301).

Post oak (*Quercus stellata*).—Missouri (A. M. 300); Santee Club, South Carolina; Longbridge, La.

White oak (*Quercus alba*).—White oaks show more evidence of sapsucker attack than any other species of the genus in the vicinity of Washington. In some localities large numbers of the trees are closely punctured and girdled. Sapsucker work is very common on this species about Afton, Va., and the tree is attacked also in West Virginia (H.) and near Winston-Salem, N. C.

English oak (*Quercus robur*).—Specimens of the horticultural variety of this species known as *Quercus sessiliflora cochleata*, the subspecies *pedunculata*, and its cultivated form *incisa*, five trees in all, on the grounds of the Department of Agriculture, bear rather abundant puncturing.

European oak (*Quercus conferta* and var. *pannonica*).—Department of Agriculture grounds, District of Columbia.

THE ELMS AND HACKBERRIES (ULMACEÆ).

This family comprises 17 native trees belonging to 4 genera. Eight of the native species and 2 introduced forms are known to be attacked by sapsuckers. Disfiguring swollen girdles have been noted on 2 species of elm and 1 of hackberry, and 1 of the elms is said to be reduced in vigor by excessive pecking.

Genus.	Number of native species.	Native species attacked.	Introduced species attacked.
Elm (*Ulmus*)	6	5	2
Water elm (*Planera*)	1	1	0
Hackberry (*Celtis*)	9	2	0
Trema	1	0	0
	17	8	2

LIST OF ULMACEÆ ATTACKED.

Cedar elm (*Ulmus crassifolia*).—Matteson, Miss. (F.).

Rock elm (*Ulmus thomasi*).—Lansing, Mich. (A. M. 280).

Winged elm (*Ulmus alata*).—Aiken, S. C. (A. M. 281).

White elm (*Ulmus americana*).—Bendire remarks that the sapsucker "is partial to the . . . elm;" and Horsford says: "I have seen an elm tree 18 inches in diameter whose trunk of 12 feet was spotted with 'gimlet holes' in the bark nearly 1 inch thick, and where for 10 summers past I have shot the pests and thereby saved the tree." A white elm in the Smithsonian grounds is much disfigured by sapsucker girdles and one near Scotts Run, Fairfax County, Va., bears more conspicuous work of the same character, some of the girdles being 3 feet long and gaping as much as 3 inches (Pl. VII, fig. 2). Specimens examined show that the tree is attacked in West Virginia (H.), Illinois, and in Butler County, Mo. (F. 26445 and 73249, respectively).

Slippery elm (*Ulmus fulva*).—Specimens examined show that this species is attacked by sapsuckers in Missouri (A. M. 278) and West Virginia (H.). Sapsucker work was noted on slippery elms near Abbeville, La., and trees seen near Longbridge, La., were covered with rows of punctures, some of which had swollen into projecting girdles.

English elm (*Ulmus campestris*) and Scotch elm (*Ulmus montana*).—In the Agricultural Department grounds are 31 elms, 9 of which are marked by sapsuckers. Some are profusely punctured and both of the European species, as well as the American elm, are attacked.

Water elm (*Planera aquatica*).—Arkansas (A. A. and A. M. 275).

Hackberry (*Celtis occidentalis*).—Iron County, Mo. (F. 72268); Allenton, Mo. (A. M. 273).

Hackberry (*Celtis mississippiensis*).—Sapsucker pecking is very abundant on trees of this species in the vicinity of Cottonport and Longbridge, La. A peculiar effect of sapsucker work on this tree is that rings of bark are often formed about the punctures. They may be half an inch in height, and as they are round and open, a cluster of them on the gray bark forms a model in miniature of a colony of cliff swallows' nests.

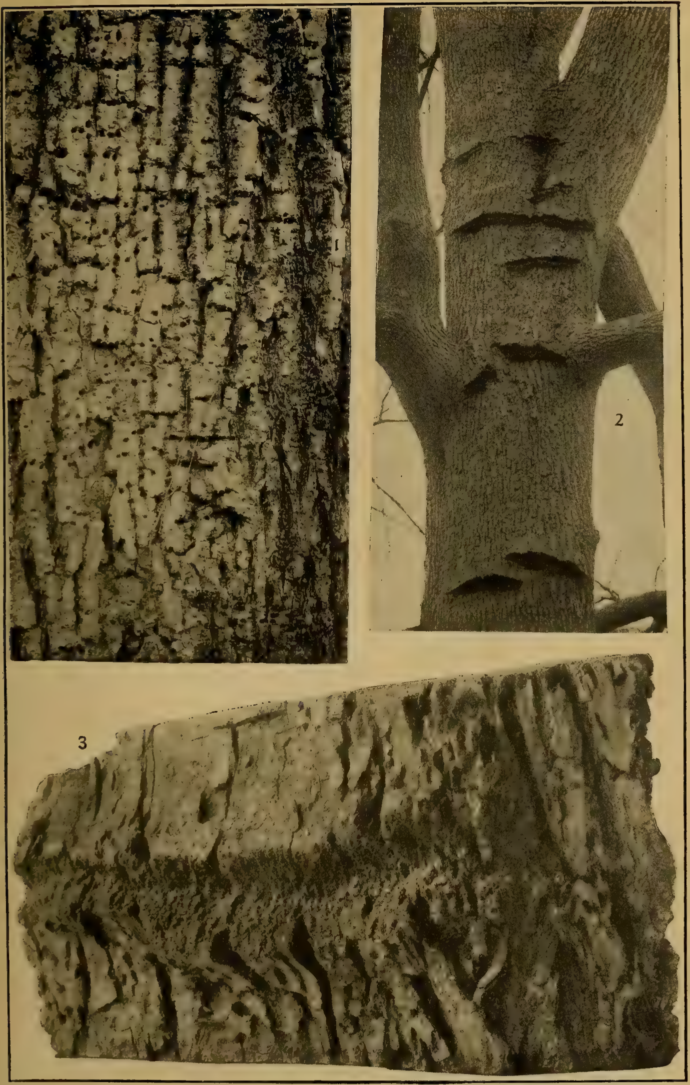
THE FOUR O'CLOCK FAMILY (NYCTAGINACEÆ).

The single arborescent species in our flora is attached by sapsuckers.

Blolly (*Torrubia longifolia*).—Florida Keys (A. M. 264).

THE MAGNOLIAS AND TULIP TREES (MAGNOLIACEÆ).

Six of the 8 native magnolias, 3 introduced species, and the single native species of tulip trees are distinct favorites of the birds. Of 22 magnolias on the Department of Agriculture grounds half have been pecked. The resulting girdles in the smooth, ashy gray bark of some of the species are unsightly, and one of the trees, a bull bay, is much roughened and distorted. The tulip tree is attacked throughout its



WORK OF SAPSUCKER ON WHITE ELM.

[1, Near view of bark showing closeness of punctures. 2, View of trunk showing swollen girdles (second one above limbs is about 3 feet long). 3, Near view of part of this girdle.]

range, but we know of no case where this species has been killed by sapsuckers. One of the magnolias, however, seems to be more seriously affected.

LIST OF MAGNOLIACEÆ ATTACKED.

CUCUMBER TREE (*Magnolia acuminata*).—Trees of this species in the grounds of the Department of Agriculture are plentifully punctured by sapsuckers, but the work is inconspicuous in their rough bark. All cucumber trees observed in the upper part of Rockfish Valley, Va., bore sapsucker work, one having several large swollen partial girdles. The species is attacked in West Virginia also (H.).

MOUNTAIN CUCUMBER TREE (*Magnolia cordata*).—Department of Agriculture grounds, District of Columbia.

BULL BAY (*Magnolia grandiflora*).—Many of the trees bordering a long avenue at the Santee Club, South Carolina, bear sapsucker work. Trees in the vicinity of Longbridge, La., are abundantly punctured, and two specimens in the grounds of the Department of Agriculture at Washington have been attacked, one so vigorously that it is disfigured by numerous girdles. L. L. Wright, of Talladega, Ala., sent in a specimen of sapsucker work from a tree of this species which, he writes, is dying from the effects of whatever it is that is "honeycombing" the bark. From about 2 feet above the ground to the top of the tree it has been girdled at intervals of 15 to 24 inches, the holes varying from contact with each other to three-fourths of an inch apart. At about 8 feet above the ground a double girdle of holes has been made about an inch apart, and so deep as to remove the entire inner bark except for about 6 inches out of a circumference of nearly 3 feet. (March 18, 1911.)

SWEET BAY (*Magnolia virginiana*).—Department of Agriculture grounds, District of Columbia; Church Island, N. C.

UMBRELLA TREE (*Magnolia tripetala*).—Illinois (F. 26401).

LARGE-LEAVED UMBRELLA TREE (*Magnolia macrophylla*).—Department of Agriculture grounds, District of Columbia.

EAST ASIAN MAGNOLIA (*Magnolia yulan*).—Department of Agriculture grounds, District of Columbia.

EAST ASIAN MAGNOLIA (*Magnolia obovata*).—Department of Agriculture grounds, District of Columbia.

EAST ASIAN MAGNOLIA (*Magnolia hypoleuca*).—Department of Agriculture grounds, District of Columbia.

TULIP TREE (*Liriodendron tulipifera*).—This species is a distinct favorite with sapsuckers. Everywhere about Washington are trees bearing abundant sapsucker work. The same is true in the vicinity of Winston-Salem, N. C., and the tree is vigorously attacked in the Rockfish Valley, Va., in West Virginia (Delslow, H. 6687; Pickens, H. 6487a), and in Illinois (F. 26403).

THE PAWPAWS AND POND APPLES (ANONACEÆ).

Two genera, each represented by one arborescent species, occur in the United States. One of these species, the pawpaw, is attacked by sapsuckers, but, so far as known, not seriously injured.

Pawpaw (*Asimina triloba*).—Arkansas (A. M. 255); Illinois (F. 26404); Fairfax County, Va.

THE BAYS AND LAURELS (LAURACEÆ).

The following tabulation shows the arborescent members of this family in the United States and the number of species attacked by sapsuckers:

Genus.	Number of native species.	Native species attacked.	Introduced species attacked.
Red bays (*Persea*)	3	2	0
Lancewood (*Ocotea*)	1	0	0
Sassafras (*Sassafras*)	1	1	0
Laurel (*Umbellularia*)	1	1	0
Camphor (*Cinnamomum*)	0	0	1
Spice bush (*Benzoin*)[1]	1	0	0
	7	4	1

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[1] Not usually classed as arborescent, but according to Dr. A. K. Fisher it becomes a tree in Fairfax County, Va.

Sassafras and camphor trees are known to be killed by the birds and all of the other species attacked are badly disfigured. These trees are used for ornament, and sapsucker injury to them counts against the bird.

LIST OF LAURACEÆ ATTACKED.

Red bay (*Persea borbonia*).—Apparently all trees of this species in the vicinity of the Santee Club, South Carolina, are attacked by sapsuckers. Most of them are profusely punctured, and the exterior of one tree was much disfigured by numerous rings of pecks which had become swollen and produced gaping, knotty girdles. At Gainesville, Fla., a large proportion of the red bays bore abundant sapsucker work.

Swamp red bay (*Persea pubescens*).—Trees of this species also were vigorously attacked near the Santee Club, South Carolina.

Sassafras (*Sassafras variifolium*).—The sapsucker injures or kills young trees (Hopkins). (Specimen from Monongalia County, W. Va., Mar. 17, 1894. Pl. XI, fig. 4.)

California laurel (*Umbellularia californica*).—A specimen from California shows evidence of severe sapsucker attack (A. A. 250).

CAMPHOR TREE (*Cinnamomum camphora*).—Camphor trees which were abundantly punctured were observed at Gainesville, Fla., and at Abbeville, La., the writer was informed that two camphor trees planted near that town had been killed by sapsuckers.

THE SWEET GUM FAMILY (ALTINGIACEÆ).

Only one species of this family occurs in the United States. It is vigorously attacked by sapsuckers apparently throughout its range, but, so far as we know, is never killed.

SWEET GUM (*Liquidambar styraciflua*).—A tree in the Agricultural Department grounds has a great many girdles of sapsucker pecks. At the Santee Club, South Carolina, almost every sweet gum tree bears sapsucker work, the bark of some being perforated as thickly as possible from top to bottom. At Gainesville, Fla., a large proportion of the trees are abundantly punctured, and the tree seems as much a favorite at Abbeville, La.

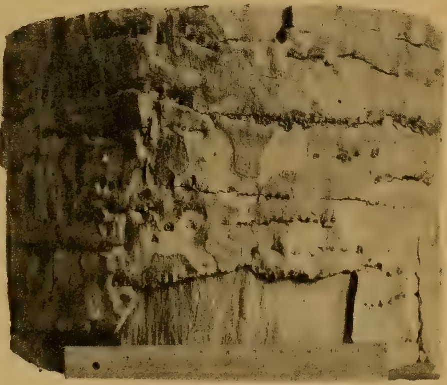

FIG. 7.—Sapsucker work on California sycamore (*Platanus racemosa*).

THE SYCAMORES (PLATANACEÆ).

Two of the three native species are attacked by sapsuckers, and although the work disfigures the smooth white bark, it is not known to decrease the vitality of the trees.

LIST OF PLATANACEÆ ATTACKED.

SYCAMORE (*Platanus occidentalis*).—Longbridge, La.

CALIFORNIA SYCAMORE (*Platanus racemosa*).—California (A. A. and A. M. 244). (Fig. 7.)

THE ROSE FAMILY (ROSACEÆ).

All of the five arborescent species of this family occurring in the United States are attacked by sapsuckers, and one (*Cercocarpus ledifolius*) is known to be much disfigured.

LIST OF ROSACEÆ ATTACKED.

(*Vauquelinia californica*).—Arizona (A. A. 242).

MOUNTAIN MAHOGANY (*Cercocarpus betuloides*).—Arizona (A. A. and A. M. 203).

MOUNTAIN MAHOGANY (*Cercocarpus traskiæ*).—Santa Catalina Island, Cal. (A. A. 205).

MOUNTAIN MAHOGANY (*Cercocarpus breviflorus*).—Huachucha Mountains, Ariz. (A. M. 204).

MOUNTAIN MAHOGANY (*Cercocarpus ledifolius*).—Eureka, Cal. (A. A. 202).

THE APPLE FAMILY (MALACEÆ).

This family contains trees of immense economic importance, as the pear, crab apple, and apple. Each of these is attacked by sapsuckers. Both kinds of apple trees are often killed and young orchards are sometimes ruined. The apple family includes also valuable ornamental trees, which are often injured or killed, especially the mountain ash. The harm done to the trees of this family weighs heavily in the case against the sapsuckers.

Species of Malaceæ known to be attacked by sapsuckers.

Genus.	Number of native species.	Native species attacked.	Introduced species attacked.
Mountain ash (*Sorbus*)	1	1	
Pear (*Pyrus*)	0	0	2
Apple (*Malus*)	5	3	2
Service berry (*Amelanchier*)	6	0	0
California holly (*Heteromeles*)	1	1	0
Hawthorn (*Cratægus*)	50+	10	2
	63+	15	6

Our information as to the number of species of hawthorn attacked must be far less complete than that concerning other genera. Species of this genus have been described in recent years by the hundred. A conservative author now recognizes 50 arborescent species in the Northeastern States, and as the genus seems to be a favorite with the sapsucker, it is probable that many more than the 10 species here recorded are attacked.

LIST OF MALACEÆ ATTACKED.

MOUNTAIN ASH (*Sorbus americana*).—Bendire notes that the yellow-bellied woodpecker is "partial to the . . . mountain ash." Merriam says: "More than half the bark is sometimes removed from the girdled portions, and the balance dries up and comes off. Therefore it is not surprising that trees which have been extensively girdled generally die." Warren notes that "in one garden [in Racine, Wis.], all the mountain ash . . . trees were entirely killed," and Dr. A. K. Fisher reports that sapsuckers killed a large mountain ash near Ossining, N. Y.

PEAR (*Pyrus communis*).—Hoy (1865) states that this species is attacked by the sapsucker, and J. M. Thompson says the pear is "one of its principal food trees."

OLIVE-LEAVED PEAR (*Pyrus elæagnifolia*).—Department of Agriculture grounds, District of Columbia.

CRAB APPLE (*Malus angustifolia*).—South Carolina (A. A. and A. M. 240).

CRAB APPLE (*Malus baccata*).—Widmann (see Bendire) says this species is occasionally punctured, and Horsford states that "the sour puckery crab apple seldom escapes." He also figures a crab apple tree which was killed by yellow-bellied sapsuckers.

CRAB APPLE (*Malus coronaria*).—Nazareth, Pa. (A. M. 239).

APPLE (*Malus malus*).—Everywhere in the United States, apparently, apple trees are subject to sapsucker attack (see Pl. V, fig. 3). The writer has noticed abundant sapsucker work on trees in Massachusetts, Maryland, the District of Columbia, and Virginia. Near Afton, Va., fully 90 per cent of the trees in an orchard of 40 acres had been pecked profusely. The apple tree is attacked in Indiana and in West Virginia (Hopkins) and many other places mentioned in the following notes, often with fatal results. Bendire says the sapsucker "materially injures and eventually kills many . . . trees. In southern Utah . . . it is said to do considerable damage to orchards in the early spring and again in fall, tapping the . . . apple trees for sap." Horsford says:

> This is the most destructive bird in our climate. I have seen the best trees in an apple orchard destroyed. . . . Where the bird breeds, whole orchards are severely injured, if not destroyed, by them. . . . The flow of sap is so diminished that the leaves fade and the fruit withers on the stem or falls to the ground. Perhaps not half the apple trees attacked are killed outright. The injury is . . . in every possible degree, from the round "gimlet hole," which is not fatal, to the broad "countersink," which kills the branch or the whole tree.

Garfield notes that "an apple tree badly pecked ceases to bear for several years." Clifford states that they "do great damage to the apple trees . . . sometimes girdling them so as to kill them entirely," and George H. Selover writes: "The yellow-bellied woodpeckers . . . have been noticed very often in the act of picking through the bark of apple trees, and quite often have destroyed the trees" (Lake City, Minn., 1885).

CRAB APPLE (*Malus diversifolia*).—Oregon (A. M. 238).

CALIFORNIA HOLLY (*Heteromeles arbutifolia*).—A trunk collected in California is much deformed. One almost complete girdle of punctures retains the characteristic appearance, while elsewhere there are irregular swollen ridges covered by roughly fractured bark, but showing traces of regularly placed holes (A. A. and A. M. 235).

HAWTHORNS (*Cratægus*).—Bendire says the sapsucker is "partial to the thorn apple," a statement fully justified. Out of a collection of 27 trunks of thorn trees in the American Museum, 13 were punctured. In the vicinity of Longbridge, La., practically all the haw trees (*Cratægus opima*) were pecked by sapsuckers, many of them showing swollen girdles.

LIST OF HAWTHORNS ATTACKED BY SAPSUCKERS.

(*Cratægus crus-galli*)—Marshall, Tex. (A. M. 229); (*C. punctata*)—Georgia (A. A. 226); (*C. lacrimata*)—Crestview, Fla. (A. M. 212); (*C. opima*)—Longbridge, La.; (*C. berlandieri*)—Columbia, Tex. (A. M. 219); (*C. boyntoni*)—Asheville, N. C., (A. M. 215); (*C. brazoria*)—Brazoria, Tex. (A. M. 224); (*C. collina*)—Asheville, N. C. (A. A. and A. M. 225); (*C. texana*)—Columbia, Tex. (A. M. 218); (*C. mollis*)—Dallas, Tex. (A. M. 220); (*C. marshalli*)—South Carolina (A. M. 211); (*C. monogyna*)—Smithsonian grounds, District of Columbia.

THE PLUMS AND CHERRIES (AMYGDALACEÆ).

This family, like the preceding, contains species of great commercial value—the peach, plums, and cherries. Two species of plums and one of cherry are known to be deformed by sapsucker work, and the cultivated peach and cherry are killed. Considerable damage is sometimes done to orchards of these trees.

Tabulation of Amygdalaceæ known to be attacked by sapsuckers.

Genus.	Number of native species.	Native species attacked.	Introduced species attacked.
Cocoa plum (*Chrysobalanus*)	1	0	0
Peach, plum, and cherry	14	6	4
Grape cherries (*Padus*)	8	2	0
Evergreen cherries (*Laurocerasus*)	4	1	0
	27	9	4

LIST OF AMYGDALACEÆ ATTACKED.

ALMOND (*Amygdalus communis*).—Penryn, Cal. (Budgett).

PEACH (*Amygdalus persica*).—Henshaw says:

> In civilized districts the injury and even destruction of fruit trees [by the sapsucker] caused by the tearing off of large pieces of bark with the apparent design of reaching the tender inner bark or juices of the tree place it on the proscribed list of the farmers. In southern Utah I visited peach orchards which had suffered severely from this cause.

Hoy (1852) notes that sapsuckers visit "the orchards during September and October to feed upon the inner bark of the peach . . . , girdling the stems so effectually as not infrequently to kill the trees."

Hog plum (*Prunus injucunda*).—Stone Mountain, Ga. (A. A. and A. M. 194).

Wild red plum (*Prunus americana*).—Florida (A. M. 199); Illinois (F. 26424).

Chickasaw plum (*Prunus angustifolia*).—Missouri (A. M. 197).

Wild goose plum (*Prunus hortulana*).—Courtney, Mo. (A. M. 198).

Garden plum (*Prunus domestica*).—Illinois (F. 26423); Wisconsin, (Hoy, 1865).

Cultivated cherry (probably *Prunus avium*).—The sapsucker is "very fond of cherry sap" (J. P. Moore, Easton, Pa., Oct. 9, 1887). It "visits the orchards during September and October to feed upon the inner bark of the . . . cherry, girdling the stems so effectually as not infrequently to kill the trees" (Hoy, 1852).

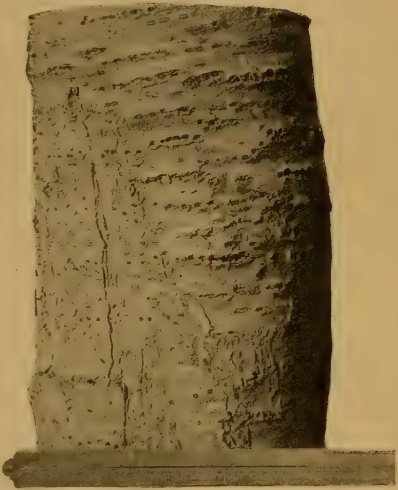

Fig. 8.—Sapsucker work on bitter cherry (*Prunus emarginata*).

Bitter cherry (*Prunus emarginata*).—Oregon (A. A. 191). (Fig. 8.)

Western choke cherry (*Padus demissa*).—California (A. M. 190).

Wild black cherry (*Padus serotina*).—Erie, Pa., Todd; Washington, D. C.; Randolph County, W. Va., (H. 6801a); Wisconsin, Hoy (1865); southern Arizona (A. A. and A. M. 188).

Islay (*Laurocerasus ilicifolia*).—California (A. A. and A. M. 185).

THE MIMOSA FAMILY (MIMOSACEÆ).

Fifteen species of this family become arborescent in the United States, only one of which, so far as known, is attacked by sapsuckers.

Mesquite (*Prosopis glandulosa*).—Arizona (A. M. 174).

THE SENNA FAMILY (CÆSALPINACEÆ).

Two of the 12 native species of trees of this family are attacked by sapsuckers, and one of them at least is much disfigured. One West Indian species also is punctured by the sapsucker.

LIST OF CÆSALPINACEÆ ATTACKED.

Water locust (*Gleditsia aquatica*).—This tree is very commonly attacked by sapsuckers near Longbridge, La., and swollen girdles are produced similar to those figured for the honey locust.

Honey locust (*Gleditsia triacanthos*).—Near Longbridge, La., nearly every tree is attacked by sapsuckers and protruding girdles are usually formed. One tree (fig. 5 and Pl. IV, fig. 3) was remarkably deformed, having shelflike girdles, some of which extend halfway around the tree and project 4 inches.

Logwood (*Hæmatoxylon campechianum*).—Bahama Islands, Moore.

THE PEA FAMILY (FABACEÆ).

Ten arborescent species of this family occur in the United States, of which two are known to be attacked by sapsuckers.

LIST OF FABACEÆ ATTACKED.

Locust (*Robinia pseudacacia*).—Randolph County, W. Va. (F. 73108).

Sonora ironwood (*Olneya tesota*).—Arizona (A. M. 154).

THE RUE FAMILY (RUTACEÆ).

Only one of the nine native arborescent species is known to be molested by the yellow-bellied sapsucker.

Satinwood (*Xanthoxylum flavum*).—Southern Florida (A. M. 150).

THE MAHOGANY FAMILY (MELIACEÆ).

The single native tree of this family, the valuable mahogany, is attacked by sapsuckers.

Mahogany (*Swietenia mahogani*).—Dr. Hopkins obtained specimens of veneer made of Cuban mahogany at Indianapolis, Ind., which prove that the sapsucker attacks this tree. A trunk collected on one of the Florida Keys has numerous pecks in the bark (A. M. 141).

THE SPURGE FAMILY (EUPHORBIACEÆ).

One of the four native arborescent species is attacked by sapsuckers.

Large Guiana plum (*Drypetes diversifolia*).—Florida Keys (A. A. 140).

THE SUMAC FAMILY (ANACARDIACEÆ).

Yellow-bellied sapsuckers attack one of the nine native trees of this family.

Smoke tree (*Cotinus americanus*).—Huntsville, Ala. (A. M. 136).

THE HOLLY FAMILY (AQUIFOLIACEÆ).

The genus Ilex includes all (11) arborescent species of this family occurring in the United States. Five of these species are known to be attacked by sapsuckers, and at least one of them (*Ilex cassine*) to be killed. Nearly all the hollies are planted for ornament. The sapsucker pecking disfigures the smooth gray or white bark and sometimes results in the death of the trees.

LIST OF AQUIFOLIACEÆ ATTACKED.

Holly (*Ilex decidua*).—Red River Valley, Ark., Hough.

Holly (*Ilex montana*).—Allegheny Mountains, N. C., Hough.

Holly (*Ilex cassine*).—Cottonport and Longbridge, La.

Youpon (*Ilex vomitoria*).—Church Island, N. C.

Holly (*Ilex opaca*).—Matteson, Miss. (F.); Fannin County, Ga., November 29, 1909 (F.); Tennessee (A. M. 129); Abbeville, La.

THE MAPLES (ACERACEÆ).

The single genus of this family in the United States consists of 21 species, 9 of which are attacked by sapsuckers, 2 sometimes being killed. Sapsucker work is recorded for 1 introduced species. Evidently in some localities maples are great favorites with the sapsuckers, and many valuable ornamental trees are killed.

LIST OF ACERACEÆ ATTACKED.

Striped maple (*Acer pennsylvanicum*).—Western Maine, Wm. Brewster; Lewis County, N. Y., Hough.

Sycamore maple (*Acer pseudoplatanus*).—Smithsonian grounds, District of Columbia.

Silver maple (*Acer saccharinum*).—Illinois (F. 26411 and 26492); Indiana, Butler (1897).

Red maple (*Acer rubrum*).—Bolles describes sapsucker work on the red maple as follows:

> The drills made by the woodpeckers began 18 feet from the ground and formed a girdle entirely around the trunk. The girdle contained over 800 punctures and was about 3 feet in height. In places the punctures or drills had run together causing the bark to gap and show dry wood within. . . . The leaves on branches above the drills drooped; those below were in good condition.

Bendire says the bird "is partial to the . . . red . . . maple," and "Hermit" states that "red maples . . . were dead or dying" as a result of the pecking. Specimens from Essex County, N. Y. (A. M. 110), and Illinois (F. 26494) also show sapsucker work.

RED MAPLE (*Acer drummondi*).—Cottonport, La.

SUGAR MAPLE (*Acer saccharum*).—Bendire states that the sapsucker "is partial to the . . . sugar maple," and Purdy calls it one of the bird's preferred food trees. Butler says:

> Choice maples are seriously damaged. . . . I have counted six of these birds at one time on a dozen sugar maples . . . and have seen the sap flow in a stream.

John Brady, of Batavia, Ill., testifies that the sapsucker hurts hard maple trees (Sept. 29, 1885), and M. S. Giles, of Waukegan, Ill., reports that sapsuckers—

> destroy more shade trees—particularly hard maple and linden—than any one thing that I know of. I set out hard maples on my place over 32 years ago and I have only succeeded in saving them by persistently killing the sapsuckers for the past 6 or 7 years—for it was only as far back as that I woke to the damage that those birds were doing to the trees. Twenty years ago this place was noted for the number of hard maple shade trees it had; to-day I can show you in my own immediate neighborhood dozens of trees that are destroyed, or partially so, from the work of the "sapsucker" [May 2, 1909].

Specimens from Morgantown, W. Va. (H.); Louisville, Ky., and Illinois, and Iron County, Mo. (F. 26493 and 72158), also show sapsucker work.

BLACK MAPLE (*Acer nigrum*).—Illinois (F. 26410).

WHITE-BARKED MAPLE (*Acer leucoderme*).—Boulden, Ga. (A. M. 113).

MOUNTAIN MAPLE (*Acer grandidentatum*).—Garfield County, Utah (A. M. 112).

BOX ELDER (*Acer negundo*).—Butler County, Mo. (F. 72128); Fairfax County, Va.; Longbridge, La.

THE BUCKEYE FAMILY (ÆSCULACEÆ).

But one of the six native arborescent species is known to be molested by sapsuckers and that but slightly.

OHIO BUCKEYE (*Æsculus glabra*).—Indianapolis, Ind. (H. 2423a).

THE BUCKTHORN FAMILY (RHAMNACEÆ).

Three of the 12 arborescent species of the United States are known to be attacked by sapsuckers. None are known to be injured severely, though the Indian cherry and the California lilac are undoubtedly disfigured.

LIST OF RHAMNACEÆ ATTACKED.

CASCARA SAGRADA (*Rhamnus purshiana*).—Seattle, Wash. (H. 174b).

INDIAN CHERRY (*Rhamnus caroliniana*).—Florida (A. M. 94).

CALIFORNIA LILAC (*Ceanothus thyrsiflorus*).—California (A. M. 91).

THE BASSWOOD FAMILY (TILIACEÆ).

Four of the eight native trees of this family are attacked by sapsuckers and two introduced species. Swollen girdles are a characteristic result, sometimes greatly disfiguring these valuable ornamental trees. One species (*Tilia americana*) is known to be killed (see p. 46).

LIST OF TILIACEÆ ATTACKED.

BASSWOOD (*Tilia americana*).—Randolph County, W. Va. (H. 6801); Waukegan, Ill., May 2, 1909, M. S. Giles; Wisconsin, Hoy (1865); Illinois (F. 26405 and 26490); Allenton, Mo. (A. A. and A. M. 88); Butler County, Mo. (F. 73188); Department of Agriculture grounds, District of Columbia; Plummers Island, Md.; Rockfish Valley, Va.

BASSWOOD (*Tilia heterophylla*).—Tennessee (A. A. and A. M. 87).

BASSWOOD (*Tilia michauxii*).—West Virginia (F. 74773).

BASSWOOD (*Tilia pubescens*).—Abbeville, La.; Florida (A. M. 86).

LINDEN (*Tilia europea*).—Department of Agriculture grounds, District of Columbia.

SILKY LINDEN (*Tilia tomentosa*).—Department of Agriculture grounds, District of Columbia.

THE FREMONTIA FAMILY (CHEIRANTHODENDRACEÆ).

The single native representative of this family is attacked by sapsuckers.

FREMONTIA (*Fremontodendron californicum*).—San Jacinto Mountains, Cal. (A. A. and A. M. 85).

THE TAMARISK FAMILY (TAMARICACEÆ.)

The single introduced species is attacked by sapsuckers.

TAMARISK (*Tamarix gallica*).—Belle Isle, La.

THE OLEASTER FAMILY (ELÆAGNACEÆ).

One introduced species of this family is known to be attacked by sapsuckers.

SILVER OLEASTER (*Elæagnus umbellata*).—Department of Agriculture grounds, District of Columbia.

THE WHITE MANGROVE FAMILY (COMBRETACEÆ).

All the native species, three in number, are attacked by sapsuckers.

LIST OF COMBRETACEÆ ATTACKED.

BUTTONWOOD (*Conocarpus erecta*).—Florida Keys (A. A. and A. M. 70).

BLACK OLIVE TREE (*Bucida buceras*).—Elliotts Key, Fla. (A. A. and A. M. 69).

WHITE MANGROVE (*Laguncularia racemosa*).—Florida Keys (A. M. 68).

THE MYRTLE FAMILY (MYRTACEÆ).

One of the seven native arborescent species is known to be attacked.

SPANISH STOPPER (*Eugenia buxifolia*).—Key West, Fla. (A. M. 76).

THE DOGWOOD FAMILY (CORNACEÆ).

Six of the 10 native arborescent species are attacked by sapsuckers. None are known to be seriously injured.

LIST OF CORNACEÆ ATTACKED.

SOUR GUM (*Nyssa sylvatica*).—Dismal Swamp, Va., H. S. Barber.

TUPELO GUM (*Nyssa uniflora*).—Illinois (F. 26433).

OGECHE PLUM (*Nyssa ogeche*).—Georgia (A. M. 66).

CORNEL (*Cornus asperifolia drummondi*).—Columbia, Tex. (A. M. 62).

FLOWERING DOGWOOD (*Cynoxylon floridum*).—Illinois (F. 26429); Cottonport, La.

WESTERN DOGWOOD (*Cynoxylon nuttalli*).—Oregon (A. M. 63).

THE HEATH FAMILY (ERICACEÆ).

Two of the 13 arborescent species of the United States are attacked, one of which is severely injured.

SOURWOOD (*Oxydendrum arboreum*).—(A. A. and A. M. 55.)

MADROÑA (*Arbutus menziesii*).—A specimen collected by Dr. Hopkins at Grant Pass, Oreg., April 25, 1899, shows large continuous horizontal areas denuded of bark. After several years' growth the wood at the bottom of these wounds is still left exposed.

THE HUCKLEBERRY FAMILY (VACCINIACEÆ).

The single arborescent species of this family is attacked and patches of its bark are killed.

TREE HUCKLEBERRY (*Batodendron arboreum*).—At Cottonport, Longbridge, and Abbeville, La., this species is abundantly punctured by sapsuckers. Most of the trees have girdles of pecks and the bark is killed in spots. The healing is slow and difficult, leaving patches of dead wood exposed and the exterior of the tree considerably distorted.

THE SAPODILLA FAMILY (SAPOTACEÆ).

Two of the 11 native trees of this family are attacked by sapsuckers.

SOUTHERN BUCKTHORN (*Bumelia lycioides*).—Florida (A. A. and A. M. 45).

ARIZONA BUCKTHORN (*Bumelia rigida*).—Western Texas or Arizona (A. A. 47).

THE EBONY FAMILY (EBENACEÆ).

One of the two native trees is attacked by sapsuckers.

PERSIMMON (*Diospyros virginiana*).—Illinois (F. 26437); Cottonport, La.

THE STORAX FAMILY (STYRACACEÆ).

One of the two native arborescent species is attacked.

SILVERBELL TREE (*Halesia carolina*).—Fannin County, Ga., December 6, 1909 (F.).

THE OLIVE FAMILY (OLEACEÆ).

Seven of the 21 native ash trees are attacked by sapsuckers, one being seriously injured. Three other genera, each with one arborescent species, complete the list of trees of the United States belonging to the olive family. One of these, the devilwood of Florida, and one introduced tree are sometimes punctured.

LIST OF OLEACEÆ ATTACKED.

BLACK ASH (*Fraxinus nigra*).—Cranesville, W. Va. (H.).

ASH (*Fraxinus oregona*).—Oregon (A. A. 23).

BLUE ASH (*Fraxinus quadrangulata*).—Iron County, Mo. (F. 72388).

WATER ASH (*Fraxinus caroliniana*).—J. M. Thompson.

GREEN ASH (*Fraxinus pennsylvanica* var. *lanceolata*).—Georgia, West Virginia (F. 72372); Venice, La.

PUMPKIN ASH (*Fraxinus profunda*).—Butler County, Mo., June 2, 1908 (F.).

WHITE ASH (*Fraxinus americana*).—Bendire remarks that the sapsucker is partial to the white ash, and Bolles notes that it is "drilled for successive years" by sapsuckers and says "the forest trees attacked by them generally die." White ash trees near Cottonport, La., bore as many punctures as the bark would hold. Sapsucker work was abundant on white ashes at Abbeville, La., and specimens showing sapsucker injury have been examined from Illinois (F. 26439); Butler County, Mo. (F. 72438); Evansville, Ind., July 9, 1904 (H.); and Marion, Ind.

DEVILWOOD (*Osmanthus americana*).—Florida (A. A. and A. M. 21).

PRIVET (*Ligustrum* sp.).—Newport, Ark. (J. W. and J. M. Stayton, May 27, 1911).

THE EHRETIA FAMILY (EHRETIACEÆ).

One of the five arborescent species of the United States is punctured by sapsuckers.

NOCKAWAY (*Ehretia elliptica*).—Texas (A. M. 17).

THE TRUMPET CREEPER FAMILY (BIGNONIACEÆ).

Three of the five native arborescent species are attacked by sapsuckers.

LIST OF BIGNONIACEÆ ATTACKED.

(*Catalpa catalpa*).—Smithsonian grounds, District of Columbia.

(*Catalpa speciosa*).—Allenton, Mo. (A. A. and A. M. 12); Illinois (F. 26441).

DESERT WILLOW (*Chilopsis linearis*).—Arizona (A. M. 14).

THE MADDER FAMILY (RUBIACEÆ).

One of the seven native trees is attacked.

BUTTONBUSH (*Cephalanthus occidentalis*) (A. A.).

THE HONEYSUCKLE FAMILY (CAPRIFOLIACEÆ).

Each of two genera of this family has five arborescent species in the United States. Of one, the elders, one species is known to be attacked and of the other, the black haws, three species. So far as known, none are seriously injured.

LIST OF CAPRIFOLIACEÆ ATTACKED.

BLUE-BERRIED ELDER (*Sambucus glauca*).—Oregon (A. M. 4).

BLACK HAW (*Viburnum lentago*).—Missouri (A. A. and A. M. 3).

BLACK HAW (*Viburnum prunifolium*).—Georgia (A. A. and A. M. 1); Illinois (F. 26435).

BLACK HAW (*Viburnum rufidulum*).—Rome, Ga. (A. A. 2).

TREES ATTACKED BY THE RED-BREASTED SAPSUCKER.

(*Sphyrapicus ruber.*)

THE POPLARS AND WILLOWS (SALICACEÆ).

BLACK COTTONWOOD (*Populus trichocarpa*).—Bendire.

COTTONWOOD (*Populus fremonti*).—C. S. Thompson.

WEEPING WILLOW (*Salix babylonica*).—"I have noticed no other trees [besides apple and pear] damaged except perhaps the weeping willow." (Ernest Adams, Clipper Gap, Cal., Apr. 30, 1909).

WILLOW (*Salix cordata*).—Vernon Bailey noted young *Sphyrapicus ruber* regaling themselves on willow sap at Donner Lake, Cal., July

25, 1900, and found many branches pecked on a number of willows. Mrs. Bailey (see bibliography), referring to the same instance, describes "lengthwise strips of bark . . . cut off, leaving fiddlestrings between." (See Pl. V, fig. 4.)

Willow (species not given).—A specimen of willow collected by Dr. A. K. Fisher at Tillamook, Oreg., shows almost all the bark removed from a fair-sized sapling.

THE WALNUTS (JUGLANDACEÆ).

English walnut (*Juglans regia*).—The English walnut is very seriously injured (Ellwood Cooper, Santa Barbara, Cal., Jan. 22, 1909).

THE BIRCHES (BETULACEÆ).

Birch (species unknown).—Prof. F. E. L. Beal reports a white-barked birch so seriously injured at Salem, Oreg., that it appeared to be dying.

THE OAKS (FAGACEÆ).

California black oak (*Quercus californica*).—All through the oak forests of the McCloud River country the black oaks were badly pecked (W. O. Emerson, Mar. 14, 1909).

California live oak (*Quercus agrifolia*).—C. S. Thompson.

THE BARBERRIES (BERBERIDACEÆ).

Barberry (*Berberis* sp.).—C. S. Thompson.

THE SYCAMORES (PLATANACEÆ).

California sycamore (*Platanus racemosa*).—C. S. Thompson.

THE APPLE FAMILY (MALACEÆ).

Mountain ash (*Sorbus sitchensis*).—"A species of mountain ash, on which none of the shoots were over 3 inches through, had been riddled all over by the birds" (Bendire).

Mountain ash (*Sorbus* sp.).—Prof. F. E. L. Beal reports an arborescent mountain ash so seriously injured at Salem, Oreg., that it appeared to be dying.

Pear (*Pyrus communis*).—The pear tree is attacked by the red-breasted sapsucker (W. O. Emerson, Haywards, Cal., Mar. 14, 1909). "A pear tree 50 or more years old stands within 20 feet of our house and the trunk and lower branches are covered with symmetrically arranged pits" (Ernest Adams, Clipper Gap, Cal., Apr. 30, 1909). At Blaine, Wash., "the sapsuckers do immense damage, especially to the pear trees" (Dawson and Bowles).

APPLE (*Malus malus*).—"Some apple trees [attacked by this species] died back at the top and did not thrive, so that I cut them down as useless" (Ellwood Cooper, Santa Barbara, Cal., Feb. 8, 1909).

> Along in February and March this species does a good deal of tapping the apple trees, more particularly in old orchards isolated in outlying canyons and mountain flats. In one old apple orchard in Culls Canyon [near Haywards, Cal.] certain varieties of apple trees are badly girdled, as the bellflower, winter pearmain, and Baldwin. This I have noticed all through the Santa Cruz Mountains, where a good many apple orchards lay.
>
> September 10, 1908, while on the McCloud River near Baird, Shasta County, I was in a small orchard patch of a dozen trees, situated in a deep ravine of the mountains, where no other orchards were in miles; these trees were the worst affected of any I ever saw by the *S. ruber* work. From within a foot of the ground up, all the main branches were literally cut up with their sap holes. It could plainly be seen where the trees had rapidly healed or grown up again and left the bark all pitted. No evil effect was noted as to small fruit, for I never saw finer sized nor colored apples in the coast counties. In a 10-mile drive from there to the railroad I observed wherever there grew an apple tree it was netted with *ruber's* sap holes. [W. O. Emerson, Haywards, Cal., Mar. 14, 1909.]
>
> All the old [20 to 50 years] pear and apple trees are badly scarred up from the ravages of this bird. . . . I have removed numbers of the old apple trees which were affected. [Ernest Adams, Clipper Gap, Cal., Apr. 30, 1909.]

THE PLUMS AND CHERRIES (AMYGDALACEÆ).

PEACH (*Prunus persica*).—Mr. Carberry stated that if he did not keep these birds in check they would kill every fruit tree he owned. At least a dozen peach trees were scarred from top to bottom with small borings of this bird (J. H. Gaut, Burney, Cal., Aug., 1905).

APRICOT (*Prunus armeniaca*).—"It taps fruit trees, especially prune and apricot. . . . Trees are frequently killed by . . . punctures. . . . The evil . . . is wrought in summer when the dry season has enfeebled the tree" (Cook).

PLUM (*Prunus domestica*).—The plum is attacked by the red-breasted sapsucker (W. O. Emerson, Haywards, Cal., Mar. 14, 1909). See also quotation under Apricot, just above.

THE RUE FAMILY (RUTACEÆ).

ORANGE (*Citrus aurantium*).—"Some complaint has been made from Riverside and Los Angeles Counties of this species cutting the orange trees badly during the winter months" (W. O. Emerson, Mar. 14, 1909). Orange trees are very seriously injured (Ellwood Cooper, Santa Barbara, Cal., Jan. 22, 1909).

THE SUMAC FAMILY (ANACARDIACEÆ).

PEPPER TREE (*Schinus molle*).—The red-breasted sapsucker is "oftenest noticed, even along the noisy city streets, in the pepper trees, the sap of which this bird seems to particularly like" (Grinnell, 1898).

THE MYRTLE FAMILY (MYRTACEÆ).

Blue gum (*Eucalyptus globulus*).—This species is injured by the red-breasted sapsucker (Ellwood Cooper, Santa Barbara, Cal., Jan. 22, 1909). "A number [of sapsuckers] have taken a fancy to a big blue gum tree in the yard, where on warm, sunny days they . . . go to peck holes and suck the rich sap that flows freely in the cold fall months" (Emerson).

TREES ATTACKED BY THE WILLIAMSON SAPSUCKER.

(*Sphyrapicus thyroideus.*)

Bull pine (*Pinus ponderosa*).—"Many grills of borings were seen in the bark of yellow pines and firs at Bluff Lake [Cal.] which I ascribed to this species" (Grinnell, 1908). A specimen from Pine Grove, Mont., collected by Joseph Brunner (H. 8516), is riddled with pecks, vertical strips of bark being cleanly removed.

Lodgepole pine (*Pinus murrayana*).—Belding remarks that Williamson sapsuckers were "breeding in living tamaracks and covered with their resinous juices," which implies that the trees were tapped.

Pine (species not given).—Merrill notes that this sapsucker is "partial to young pines, with the soft inner bark of which, and fragments of insects, the stomachs of adults are usually filled."

White fir (*Abies concolor*).—See quotation from Grinnell under Bull pine.

SUMMARY OF INJURIES JEOPARDIZING THE VIGOR OR LIFE OF TREES.

Condensing the information contained in the foregoing lists, we find that the yellow-bellied sapsucker attacks no fewer than 246 species of native trees and 6 vines, besides 31 kinds of introduced trees. Twenty-nine of these trees and 1 vine are known to be sometimes killed and 28 others are much disfigured or seriously reduced in vitality.

The red-breasted sapsucker, a bird much less observed, is known to attack 20 species of trees and shrubs, to damage individuals of at least 11 of them, and sometimes to kill members of 8 species. Considering the smaller range of this sapsucker and our comparative unfamiliarity with its habits, there is little doubt that bird for bird it is fully as detrimental to trees as the more widespread yellow-bellied woodpecker.

The Williamson sapsucker is here recorded as attacking 3 species of the pine family.

Combining the statistics for the 3 species of sapsuckers, we find that they are known to attack 258 trees, shrubs, and vines of 45 native families. These families are represented by 603 arborescent species in the United States, of which 248 are known to be punctured by sapsuckers. Thirty-eight introduced species are attacked, which belong to 17 families, 3 of which have no native representatives. Sixty-three of the total number of trees and shrubs are seriously damaged by sapsuckers and 31 of them, besides 1 vine, are known to be killed. There are 31 families of plants having native arborescent species in this country, and 7 wholly introduced families, no member of which is known to be attacked by sapsuckers. However, these families average less than 2 species each, while the native families, including the 258 species attacked, contain an average of 14 species each, so that our negative results for the former group are probably due in great part merely to the small amount of material examined rather than to the sapsuckers' distaste for trees of these families.

Indeed it seems probable that practically all trees accessible to sapsuckers will sooner or later be attacked. The only widespread and numerous trees not yet known to be punctured are the mulberries, Osage orange, and figs (family Moraceæ), and the palms and yuccas belonging to the endogenous subclass of plants, in which the circulation of sap is peculiar, which are presumably unsuited to sapsuckers.

The evidence shows that the three species of sapsuckers have practically the same habits and consequent injurious effects upon trees. However, the Williamson sapsucker is not now known to harm trees of great value. Leaving this species out of consideration and speaking only of the red-breasted and yellow-bellied sapsuckers, the above detailed testimony abundantly confirms the conclusion drawn from the anatomical structure and stomach examination, namely, that sapsuckers habitually feed upon bast, cambium, and sap. It further shows that in securing their favorite food they often remove so much of the growing layer of trees that the vigor of the latter is impaired, sometimes to such a degree that death ensues.

However strong seems the indictment against the sapsuckers, it must not be imagined that every tree pecked by them is doomed. On the contrary, they frequently work on a tree year after year without noticeably diminishing its vitality. Near Washington the writer has noted large elms whose trunks have evidently been attacked by many generations of sapsuckers and are freely drilled every year, but which to all appearances are now in perfect health. W. A. Taylor, of the Division of Pomology in the Department of Agriculture, states that at his home in southwestern Michigan there are several apple trees, now over 70 years old, which are known to have been yearly drilled by sapsuckers without diminishing their vigor or productiveness. The western half of the Department of Agriculture grounds at Washington contains 232 trees, of which 56 have been attacked by sapsuckers.

Only one of these gives external evidence of injury, an English walnut, one limb of which has been partly killed, and only a few are noticeably disfigured.

While there is no doubt that trees may be freely attacked by sapsuckers without their lives being endangered, it is equally true that many trees, including valuable orchard and ornamental specimens, are seriously injured or killed by these woodpeckers. The owners of such trees have every right to protect them and should be given legal authority to do so.

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EFFECTS OF SAPSUCKER WORK ON LUMBER AND FINISHED WOOD PRODUCTS.

INTRODUCTION.

Those relations of sapsuckers to trees which are detrimental to man's interest are by no means confined to the external disfiguration, the weakening, or killing of trees. Indeed in the aggregate sapsuckers inflict much greater financial loss by rendering defective the wood of the far larger number of trees which they work upon moderately but do not kill. Blemishes, reducing the value, appear in the lumber from such trees and in the various articles into which it is manufactured.

These defects consist of distortion of the grain, formation of knotty growths and cavities in the wood, extensive staining, fat streaks, resin deposits, and other blemishes. All of them result from injuries to the cambium, their variety being due to differences in the healing. Besides blemishes, ornamental effects are sometimes produced during the healing of sapsucker wounds, such as small sound stains, curly grain, and a form of bird's-eye.

The earliest communication we have on this point is from Charles Eshorn, jr., of Medora, Ind. On May 27, 1892, he wrote to the Biological Survey as follows:

> [The sapsucker] ruins a great deal of valuable forest timber, namely, oak and hickory, by pecking holes. . . . As the tree grows these places decay, which renders the timber unfit for spokes, staves, etc. These birds are not very numerous, but it seems that each individual can do a great deal of mischief, and should the country be overrun with them they would be a great drawback to the timber business.

The relation of sapsuckers to lumber was first studied by Dr. A. D. Hopkins while he was connected with the West Virginia Agricultural Experiment Station. He discovered that curly and bird's-eye wood are often caused by injuries to living trees by woodpeckers. Dr. Hopkins read a paper on the subject before section F of the American Association for the Advancement of Science,[1] and another before the American Forestry Association in August, 1894, and he spoke on the same subject at a meeting of the Biological Society of Washington March 25, 1902. Dr. Hopkins has generously turned over to the Biological Survey the manuscript and photographs illustrating the latter communication, in addition to his large collection of wood samples showing woodpecker work. This collection, augmented by material gathered by the writer in the field or examined in various museums, forms the basis of this section of the bulletin.

In his address on "Ornaments and blemishes in wood caused by insects and birds," [2] Dr. Hopkins says:

> Blemishes or defects appear in lumber and wood finish as discolored spots, checks, dark stains, resin deposits, pinholes, wormholes, etc., and in the trees as scars, decayed spots, and hollow trunks.
>
> Ornamental conditions appear in the lumber and inside finish and furniture as so-called bird's-eye, curly, burl, and wavy or satined effects and on the surface of the wood beneath the bark as artistic and curious carved and embossed work.
>
> Twenty or thirty years ago, when the choicest material could be selected from an abundant and cheap supply, blemishes were rarely seen, even in the cheaper finished products. Within recent years, however, the supply of choice lumber free from defects is becoming so scarce that none but the most expensive finished articles are entirely free from them. Indeed, it would be difficult to find a recently constructed public building or private residence which does not show in the natural wood finish one to many blemishes, the result of various causes. Most of them which are not natural conditions in the wood are caused primarily by insects, birds, mammals, and various other agencies which produce wounds in the cambium of the living tree.

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[1] Hopkins, A. D., Some interesting conditions in wood resulting from the attack of insects and woodpeckers. Proc. Am. Assn. Adv. Sci. 1894, p. 252 [abstract]. Excerpts from this paper were published by Dr. Hopkins under the title "The Relation of Insects and Birds to Present Forest Conditions," in Garden and Forest, VII, 348 and 373, 1894. Its subject matter was brought before the Biological Society of Washington by Prof. C. V. Riley, Dec. 15, 1894, in a paper entitled "Some Interesting Results of Injuries to Trees;" and a review by H. C. Hovey appeared in the Scientific American, LXXI, 163, 1894.

[2] Meeting of Biol. Soc. Wash., Mar. 25, 1905.

The condition in wood of various kinds resulting from the everywhere common work of the class of woodpeckers known as sapsuckers in the bark of forest and cultivated trees has been the subject of special interest to me for many years, and my work on forest insects has naturally offered a good opportunity for observations and the collecting of specimens. The material collected represents some 40 species of forest trees of many genera and families and from widely differing sections of the country.

It appears that the object of the sapsucker working in the bark of living trees is to secure both liquid and solid food from the sap, cambium, and bast, and not for the purpose of collecting insects, or at least not primarily for that purpose. The punctures in the bark vary in size, form, and arrangement according to the species of tree and the character of the food furnished. In the pine, spruce, hemlock, juniper, and probably in all conifers, the desirable substance is furnished by the living bast tissue and cambium, while the wood yields resin instead of sap; therefore the birds have no occasion to puncture the outer wood ring and very rarely do so, whereas in maple, walnut, hickory, and such trees as furnish at certain times of the year a profuse flow of saccharine sap from the sapwood the outer ring of wood is generally punctured. In the former the wounds are usually broad, often connected, and arranged in longitudinal rows,[1] while in the latter they are narrow, funnel-shaped, rarely joining, and arranged in transverse rows. The method of healing of these wounds is quite variable, being influenced not only by the character of the wound but by the species or class of trees in which they occur. The resulting defective or ornamental conditions and subsequent annual layers of wood also vary in character and economic importance with different kinds of trees and commercial products.

The way in which sapsucker pecks are healed and the characteristic blemishes and ornamental effects produced may best be understood by the detailed consideration of these effects in a tree in which they are well marked. For this purpose the sugar or hard maple[2] (*Acer saccharum*) is selected, a favorite tree of the sapsuckers and one often seriously injured by them. The punctures sometimes penetrate only to the sapwood, but generally they pierce one or more annual rings. Whatever the character of the original wound, more or less staining, varying from light yellow to dark brown in color, takes place in its vicinity and sometimes extends several inches up and down the grain. The greater the injury to the sapwood the more extensive is the stain. When the sapsucker's drill extends only to the sapwood, distortion of the wood healing the wound is usually at a minimum. It can make excess growth only by bulging out into the hole in the bark. Upon the extent of this swelling depends the amount of abnormality in succeeding annual rings.

Figure 9A of the excellent series furnished by Dr. Hopkins illustrates this type of healing. Here the excess growth was small and would probably have been smoothly covered by the next annual layer, though a second stain would have been produced owing to exposure of the cambium. Figure 9B further shows the results of failure to close the hole in the bark and to cover the original wound, thus leaving the sapwood exposed and liable to increased staining. A cone of cambium and bast has formed over the bottom of the peck, which will persist permanently as a rounded protuberance and over which all succeeding wood layers will be molded. A condition similar to this in a specimen having one layer of sapwood excavated is shown in the next figure (fig. 9C). The wound is not closed, the wood is left exposed, and if the healing has been completed for the season, an inwardly projecting cone will be left as before which will affect the form of future annual rings. Figure 9D shows a specimen in which two rings of sapwood have been punctured and the next year's growth has been vigorous, filling the original wound and pushing out into the hole in the bark. Succeeding wood layers would be bent outward over the protuberance which partly fills the wound. The conditions in wood which has made several years' growth since the original injuries is shown in figures 10A and 10B. Both illustrate specimens in which the sapwood was punctured and extensive staining has resulted. In one case vigorous growth followed the injury and the healing has taken place as in figure 9D, with the result that the annual layers of wood are bent outward over the wound. The other specimen gives evidence of weaker growth, only partly filling the original hole and not pushing out into the bark opening. Hence the more vigorous new bast pushed into the vacancy, forming a protuberance on the inner side of the bark, between which and the depression over the original wound the next layer was formed. In consequence the latter also was bent inward and so was every succeeding layer.

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[1] Probably the contour of the bark has much to do with the arrangement of punctures. Conifers often have very thick bark but with longitudinal cracks where the wood can be more quickly reached. Vertical series of pecks occur on deciduous trees also, especially upon those having long ridges or strips of thick bark with furrows between

[2] The specimens of hard maple here discussed were collected at Morgantown, W. Va. (Hopkins), and in Illinois (F 26493)

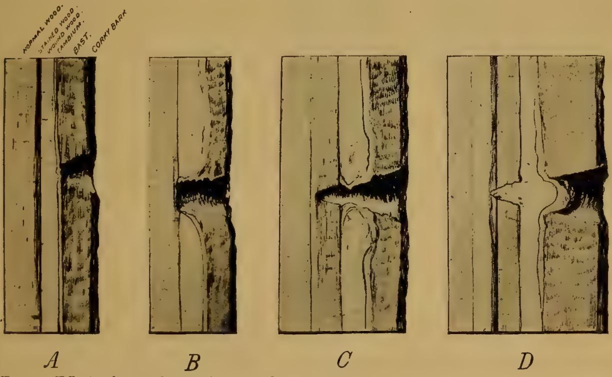

FIG. 9.—Effects of sapsucker work on wood of sugar maple (*Acer saccharum*). (From Hopkins.)

To recapitulate, figures 9A to 9D show wounds 1 year old healed in various ways. Least progress is shown in B and C, in both of which the wound has failed to close. A conical projection is formed on the inside of the bark, which makes a deep depression in following wood layers, as is illustrated by figure 10A. Figures A and D show wounds promptly closed by more vigorous growth. In figure A, as the peck extended only to the sapwood, the succeeding annual layer is smooth internally and because of small growth only slightly distorted externally under the bark hole. In figure D one ring of sapwood is entirely and another partly pierced. The new growth has been so thrifty that the original peck has been filled and a plug also pushed out into the bark opening. Methods of healing as illustrated by figures 9A, 9D, and 10B produce a pit on the inner side of the bark which causes corresponding elevations in succeeding layers of wood. As a rule, then, if the growth following sapsucker wounds is vigorous, succeeding layers of wood will be bent outward over the wound; if weak, the grain will bend inward. In either case radial sections (fig. 10) of the wood reveal the curl in the grain and tangential sections cutting through the curls show a condition resembling natural bird's-eye (Pl. IX, fig. 6). As it can usually be recognized from the arrangement of the bird's-eyes in rows (see Pl. XII) corresponding to the well-known type of sapsucker work in the bark, it may well receive the name of sapsucker bird's-eye.

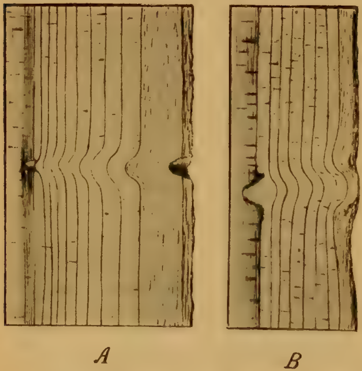

FIG. 10.—Effects of sapsucker work on wood of sugar maple (*Acer saccharum*). (From Hopkins.)

The question now arises, What is the effect of sapsucker work upon the commercial value of hard maple wood? The bird's-eye and curl, and even small stains if hard and sound, may be considered as ornamental and as enhancing the value of the wood. But extensive staining, a common accompaniment of sapsucker work in hard maple, is detrimental. Furthermore, the original pecks, if on the surface, appear as cavities surrounded by bleached and stained wood (Pl. IX, fig. 4), which must be planed off before the wood can be put to decorative use. The strength of the wood is not greatly affected except when pecks are numerous in a single annual layer, in which case this layer constitutes an easy splitting plane.

The failure of the original wounds to close or the formation of loose, knotty, and gnarled tissue, together with excessive staining, are serious defects which greatly reduce the market value of the lumber, as may readily be seen from the following definition of the grades of maple lumber:

> *Firsts.*—Firsts must be 8 inches or over wide, 10, 12, 14, and 16 feet long, and free from all defects, except in pieces 10 inches or over wide, which may have one sound standard defect.
>
> *Seconds.*—Seconds must be 6 inches or over wide, 8 to 16 feet long; pieces 8 feet long must be clear. . . .
>
> *No. 1 commons.*—No. 1 commons must be 3 inches or over wide, 6 to 16 feet long; pieces 3 or 4 inches wide must have 1 face clear.—[Inspection rules, National Hardwood Lumber Association.]

It is evident that lumber sawn from a maple abundantly punctured by sapsuckers would not fare well at an inspection. Very few, if any, clear pieces of the sizes above specified, the smallest of which is 3 inches wide by 6 feet long, could be obtained from such a tree. Hence most of the lumber would be classed as No. 2 common, the fourth market grade, which means a heavy loss.

The effects of sapsucker work in other trees are more or less similar to those in hard maple, but vary according to the extent of injury and the habits of growth of the tree. For instance, the defects are usually much more pronounced in trees in whose bark holes remain open long, whether owing to slow growth or other reason. On the other hand, trees of rapid growth quickly heal and the blemishes are small and soon deeply buried. Wood with especially porous grain is extensively stained, while dense wood is less affected.

Defects due to sapsucker work are sufficiently similar in a general way, however, to be identifiable in any wood. On the end of logs, healed supsucker wounds or bird pecks, as they are commonly called, appear as larger or smaller stains with more or less open fissures or checks extending a short distance toward the bark. The general effect is that of T-shaped or triangular marks or cavities surrounded by more or less stain. Several usually occur along the same wood ring (see figs. 24, 29, 33, 37; Pl. VIII, fig. 2; Pl. X, fig. 3). The checks may be continuous, in which case they constitute a defect known as rind gall (see figs. 30 and 35). In longitudinal section, as in most boards and in quarter-sawn or sliced material, bird pecks usually appear as small knots (also often T-shaped—figs. 15, 16, and 23) around which is a greater or less amount of stained wood. They are easily distinguished from true knots, however, which are due to adventitious buds and embedded bases of twigs and limbs. The gnarly or curled growth caused by bird pecks is all on one side of a line of separation between annual rings (see figs. 15, 17, 22, and 23). In other words, the distortion of grain is confined to a half circle. An ordinary knot has no such definite relation to the wood layers, and is likely to be approximately circular in section. In rotary cut material and of course occasionally in ordinary lumber (longitudinal sections), bird pecks are cross sectioned, and generally show as transverse oblong holes, sometimes filled with loose wood, from which stains run up and down the grain (see figs. 11, 18, and 20). It is probable that the wounds made in trees by other woodpeckers sometimes heal so as to present the same appearance as sapsucker pecks; but these generally occur only as isolated blemishes, not in series, as sapsucker pecks nearly always do. Sapsucker pecks vary in economic bearing in different trees according to their abundance, the character of defects and ornaments produced, the uses to which the lumber is put, and its value.

WOODS IN WHICH BLEMISHES OR ORNAMENTAL EFFECTS ARE KNOWN TO RESULT FROM SAPSUCKER WORK.[1]

THE YEW FAMILY (TAXACEÆ).

Defects due to sapsucker pecking have been observed in two species of this family. In the stinking cedar they are unimportant. In the Florida yew, however, their nature and extent are such as to ruin both the appearance and the strength of the wood. They consist of small (one-fourth inch) black stains, accompanied by open knotty checks, gnarly grain, and long, open resinous seams, which in some cases constitute a complete cleavage between annual layers very similar to the defect known as cup shake.

THE CONE-BEARING TREES (PINACEÆ).

This family includes the most important timber trees of the United States. We find defects produced in the wood of 29 of the 90 native species. Ordinarily these defects vary from small to extensive brown or black, often transverse, stains to open checks up to an inch and a half in length, accompanied by fat streaks, resin deposit, and curled or gnarly grain in the wood layers overlying the healed punctures. Such defects have been observed in the following 12 species: White bark pine, lodgepole pine, long-leaf pine, scrub pine, red spruce, tideland spruce, eastern hemlock, Douglas fir, red fir, and three species of white firs. The injuries are sufficient to keep lumber containing them out of the better grades used for finishing purposes. This involves the loss of a large percentage of the selling price, and the damage may reach serious proportions, as trees of this family are sometimes vigorously attacked. While the ordinary defects in the wood are undoubtedly a source of weakness in small pieces, they are of no account in large beams and other heavy construction material, for which these woods are much used. The long-leaf pine and white fir described below illustrate defects of this character.

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[1] In this list the family summaries give general conclusions regarding defects. Full accounts are given of species showing typical or severe injuries, and the treatment of each family closes with a list of all the species in which blemishes or ornaments have been observed.

Where no locality or museum collection is cited, the specimens referred to are those given in the list of trees injured or killed (pp. 21-53). Where several specimens of a species are mentioned in that list, the particular specimens discussed here are indicated by citation of the locality or museum initials. The species recorded do not indicate the total damage done to lumber by sapsuckers, as we have been able to examine wood specimens showing defects in only 70 per cent of the species known to be attacked by sapsuckers, and that list is by no means complete.

Sapsuckers render certain woods of this family valueless for even coarse construction. They remove large areas of bark, usually in narrow vertical strips, and the injuries are so extensive as to leave cleavage places in the wood. Defects of this character have been observed in bull pine, pitch pine, Engelmann spruce, and western hemlock.

Injuries less extensive, but important because of special uses of the lumber, are described below for red cedar and cypress. In Monterey cypress and desert juniper the small black checks and brown stains are sound or accompanied by so much curled grain and bird's-eye that they embellish the wood.

Sapsucker wounds afford favorable conditions for the entrance and growth of a fungus (*Peridermium cerebrum*) which produces large galls on pine trees. When abundant, these galls so distort the trees that they become useless for lumber. Observations upon scrub and short-leaf pine show that not infrequently the fungous attack begins in sapsucker wounds.

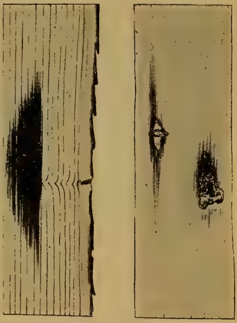

FIG. 11.—Effects of sapsucker work on wood of long-leaf pine (*Pinus palustris*). Radial and tangential sections. (From Hopkins.)

LONG-LEAF PINE (*Pinus palustris*).—Black stains with resin deposit are produced about sapsucker wounds in this wood, and lighter stains extend some distance along the grain. These shade off into fat streaks, which may permeate many layers of wood and reach far up and down the grain. Figure 11 shows the appearance of healed bird pecks in this pine. The illustration of the tangential section does not show as extensive staining as is sometimes present. The cavities there delineated are filled with resin. (Specimens from Baldwin, Fla.; Boardman, N. C.; and Buna, Tex.) A specimen from Florida (A. M. 485) shows a series of very extensive pitch streaks half an inch in thickness and 3 to 4 inches long in one direction from the wound. Blemishes in the long-leaf pine are serious enough to keep the lumber out of finishing grades.

White fir (*Abies concolor*).—The defects are one-fourth to 1 inch long, filled with resin deposit and giving rise to fat streaks extending a foot or more along the grain. Many layers of wood over the wound have curly grain. The blemishes are of no consequence for coarse structural work, but destroy the value of the wood for ornamental purposes (Oregon, A. M. 444).

Western hemlock (*Tsuga heterophylla*).—A specimen of this wood collected at Detroit, Oreg. (H.), shows reddish to black resinous scars 1 to 3½ inches long, and the wood immediately over the wound gnarled and distorted, and one or two annual rings impregnated with a black crystalline resin deposit. The smaller blemishes produced by sapsucker work are practically identical with those described by H. E. Burke as black check, which is caused "by an injury to the cambium . . . by the hemlock bark maggot, *Cheilosia alaskensis*." Mr. Burke says: "Timber badly affected with this defect is nearly worthless for finishing, turning, staves, and woodenware, for which it would otherwise be excellent."[1] But injuries by sapsuckers generally occur on a larger scale and consequently are more damaging. Specimens of western hemlock collected by Mr. Burke at Hoquiam, Wash. (H. 2167a), show the removal by sapsuckers of long vertical strips of bark, exposing the sapwood (Pl. VIII, fig. 3). This weathers to a dark color and when healed over persists as a darkly stained area from 2 to 3 inches wide and up to several feet long with more or less resin deposit, making a thin brittle layer in the wood along the plane of which splitting easily occurs (Pl. VIII, fig. 5). The defect is extreme, both as to weakness and unsightliness, and when abundant and scattered throughout the wood, as sapsucker blemishes usually are, must render the wood valueless for all structural purposes. Besides the direct injuries to western hemlock by sapsuckers, their pecks in the bark furnish entrance to bark maggots.

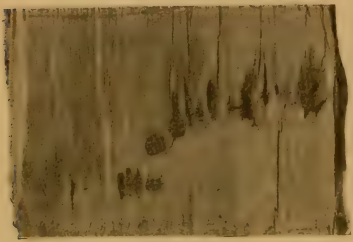
Fig. 12.—Effects of sapsucker work on wood of bald cypress (*Taxodium distichum*). Checks and stains.

Bald cypress (*Taxodium distichum*).—Specimens from Boardman, N. C. (H.), show dark stains produced by sapsucker wounds in cypress and distortion of the grain in several annual rings, some of which give a bird's-eye appearance in tangential section. Pieces of cypress from Cottonport, La., have numerous black stains (fig. 12) from one-fourth to 1½ inches in length and often nearly contiguous. In some cases the holes drilled by the sapsuckers have not healed readily and have left

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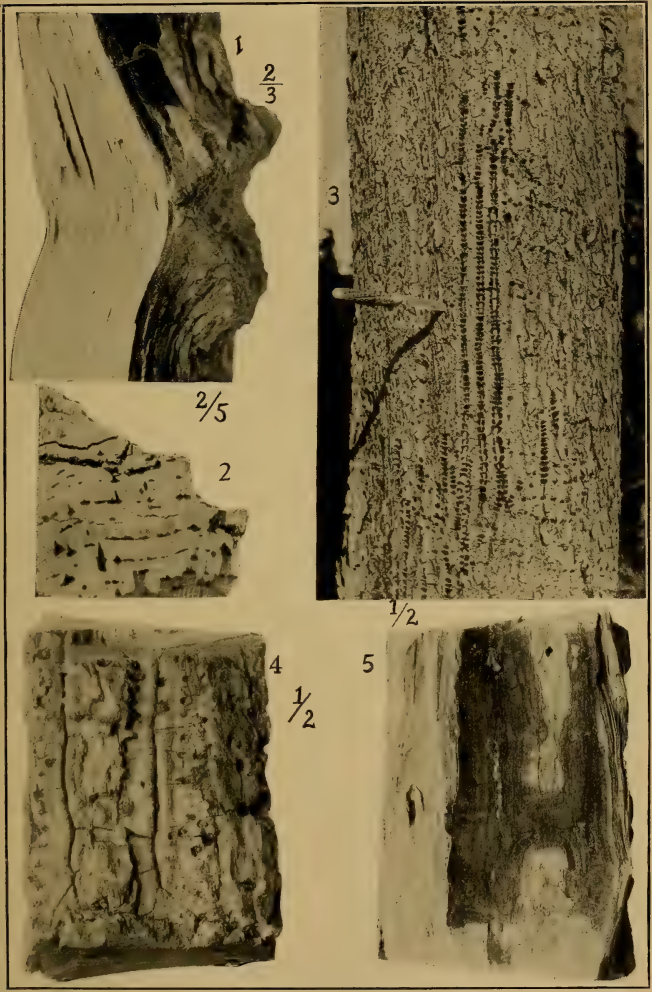
[1] Bureau of Entomology, Circular No. 61, p. 1, 1905.



WORK OF SAPSUCKER ON WHITE ELM AND WESTERN HEMLOCK.

[1, Radial section through swollen girdle on white elm, showing strong curl of grain. 2, Cross section; checks and stains. 3, Long vertical series of punctures in western hemlock. By H. E. Burke. 4, Exterior view of healed-over wounds of similar nature. 5, Interior view; extensive stain.]

open checks. Some of these form a narrow open knot an inch long. Distorted grain is very abundant and ranges from ornamental bird's-eye to abundant bunches of gnarls (fig. 13), which ruin the appearance and workability of the wood.

At Cottonport, La., the writer had an opportunity to learn what proportion of the wood of cypresses abundantly punctured by sapsuckers is defective. Out of 189 palings split from one cypress, 29, or nearly 16 per cent, bore enough black stains to ruin the wood for any ornamental purpose. In a lot of 322 palings, 111, or nearly 39 per cent, showed much gnarled grain accompanied by a few black spots. The gnarly wood and open knots are most objectionable in cypress, which is much used for purposes requiring easy working qualities and strength in slender pieces—for instance in greenhouse construction.

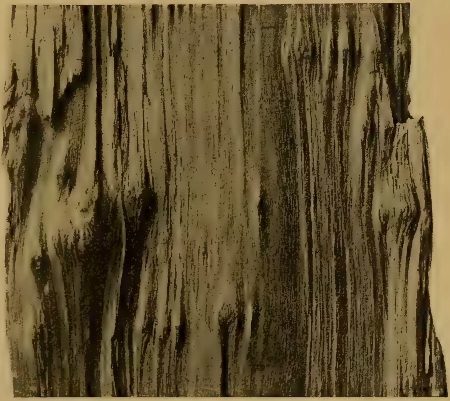


FIG. 13.—Effects of sapsucker work on wood of bald cypress (*Taxodium distichum*). Gnarly grain.

NORTHERN RED CEDAR (*Juniperus virginiana*).—Sometimes open fissures extend from checks toward the bark, surrounded by stain and gnarly wood. Even more objectionable are cases where the grain of the wood about the healed punctures is very wavy and each scar has one or more outwardly projecting tubercles (fig. 14, and Pl. XI, fig. 3), varying up to an inch in length, and requiring at least two complete annual rings of wood to bury them. These tubercles, together with the gnarled grain and extensive resin deposit, produce a hard, knotty, brittle layer of wood. The wounds have small cavities and light but continuous stains. Wood thus disfigured is unsightly and unworkable. The greater part of the output of red cedar is used for pencil wood, for which the requirements are very exacting. A soft wood, even and straight grained, free from defects, is essential.[1] Trees of this species are very commonly worked on by sapsuckers, and often they are covered with rings of pecks. The writer found 19 out of 40 trees punctured on a small area on Plummers Island, Md. It is evident that considerable loss may be occasioned by the work of sapsuckers on red cedar. (Specimens from Plummers Island, Md.; Kanawha Station, W. Va. (H.); Illinois (F. 26487); and Florida (A. M. 417).)

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[1] White, L. L., Circular 102, Forest Service, p. 5, 1907.

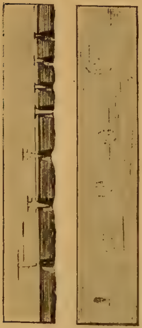


FIG. 14.—Effects of sapsucker work on wood of red cedar (*Juniperus virginiana*). Radial and tangential sections. (From Hopkins.)

SPECIES OF PINACEÆ BLEMISHED.—Whitebark pine, nut pine, bull pine (by Williamson sapsucker, H. 8516), lodgepole pine, long-leaf pine, pitch pine (H.) (Pl. XI, fig. 2), scrub pine, red spruce (H.), Engelmann spruce, weeping spruce, tideland spruce, eastern hemlock (H.), western hemlock, Douglas fir, *Abies concolor*, *A. grandis*, *A. amabilis*, *A. magnifica* (fig. 15), *A. nobilis*, big tree, bald cypress, incense cedar, canoe cedar, Monterey cypress, Macnab cypress, white cedar (H.), desert juniper, western juniper, and northern red cedar.

THE POPLARS AND WILLOWS (SALICACEÆ).

The defects due to sapsucker work on poplar vary from small, slightly stained checks to large open knotty cavities, bordered or partly filled with decayed wood. Sometimes these checks cause the development of adventitious buds, thus making true knots. Over these, as well as over the normally healed pecks, are curls in the grain, which in some cases are duplicated through a great many annual layers (fig. 16). These ornament the wood, but it is doubtful if they counterbalance the disadvantage of the many large checks. The latter unfit the wood of black cottonwood, tacmahac, and Carolina poplar for one of its principal uses—the manufacture of tubs, barrels, and woodenware.

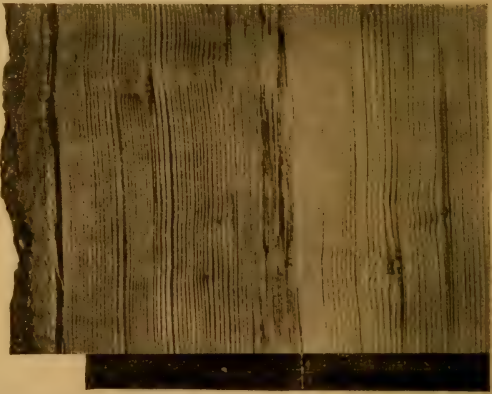


FIG. 15.—Effects of sapsucker work on wood of red fir (*Abies magnifica*). Checks, stains, gnarled and curled grain.

Sapsucker work in willows is difficult to identify, both because the pecks in the bark are quickly effaced and because the appearance of the defects in the wood is so often complicated by adventitious buds. The usual appearances in the wood are small light stains and nipple-like projections over the healed wounds and consequent outward curling of the grain of many layers of wood (fig. 16). However, the checks and stains may be large and black (fig. 17), and extensive light stain may permeate the wood in all directions from the original wound. The checks are sometimes filled with softer, lighter-colored wood, and when adventitious buds develop they increase the distortion of the grain and sometimes form true knots. Willow wood is little used in the United States, but the distortion of the grain caused by sapsuckers by no means improves it for any purpose.

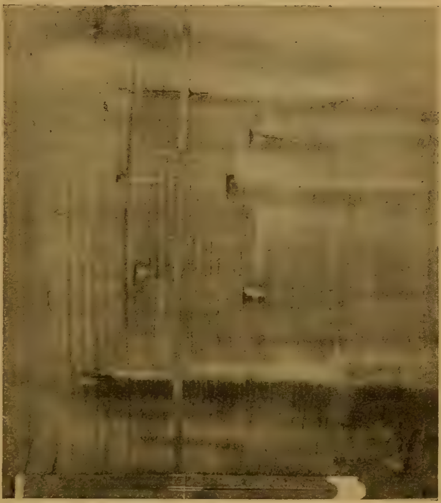


FIG. 16.—Effects of sapsucker work on wood of black cottonwood (*Populus trichocarpa*). Checks, stains, buried adventitious buds, and curled grain.

SPECIES OF SALICACEÆ BLEMISHED.—Silver poplar (H.), swamp poplar, black cottonwood (fig. 16), balm of Gilead, tacmahac (A. A.), Carolina poplar (A. M.) (fig. 17), *Salix longipes*, *S. lævigata* (A. A.), *S. toumeyi* (A. A.), *S. amygdaloides*, *S. lasiandra*, *S. interior*, *S. sessilifolia*, *S. missouriensis*, *S. lasiolepis*, *S. hookeriana*, *S. taxifolia* (A. A.), *S. sitchensis*, *S. discolor*, *and S. scouleriana*.

THE BAYBERRIES (MYRICACEÆ).

Defects due to sapsucker pecking have been noted in three of the four native arborescent species of this family—the bayberry, wax myrtle, and California bayberry. The blemishes vary from small brown checks to large open ones and black stains up to 2 or 3 inches square, but on account of the limited use made of the wood they are of economic significance in but one species, the California bayberry, which is used in cabinet work and turnery.

THE WALNUTS AND HICKORIES (JUGLANDACEÆ).

The trees of this family furnish the most costly woods produced in the United States. They are frequently attacked by sapsuckers and the resulting injuries are severe and often ruin the lumber, except for fuel or heavy construction. Serious defects have been observed in the wood of 12 of the 19 native species, and probably all of them are subject to sapsucker injury. In black (fig. 18) and in Texan walnut, the defects consist of heavy black stains running far along the grain and black checks, either filled with loose plugs or open and knotty. They spoil the ornamental appearance of these woods.

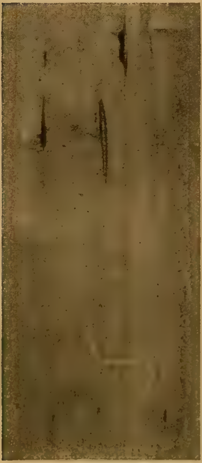


FIG. 17.—Effects of sapsucker work on wood of Carolina poplar (*Populus deltoides*). Large checks and gnarled grain.

In hickory (Pl. X, figs. 2 to 4, and Pl. XI, fig. 1) the blemishes consist of open black checks (varying in size up to 2 by 4 inches), sometimes soft walled or partly filled with spongy growth, frequently connected with gnarly fissures up to 2 inches in length, which usually extend toward the bark. These are surrounded by brown or black stains called iron streaks, which penetrate more or less wood adjoining the wound and follow the grain sometimes for many feet. They are serious in all the species examined. Mr. Carlos G. Bates of the Forest Service says: "The hickory is oftentimes damaged beyond the effect of the streak. As the wound made by the bird heals over, a small lump is formed over the spot, and stimulated to hypertrophied growth (by the lack of pressure where the bark has been removed). This in time becomes a sort of tubercle standing out at right angles to the stem and protruding through the bark. Sooner or later it ceases to grow, and the normal growth of the tree buries it, leaving a flaw in the wood equal to a large, loose knot."

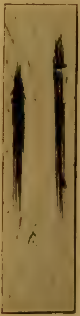
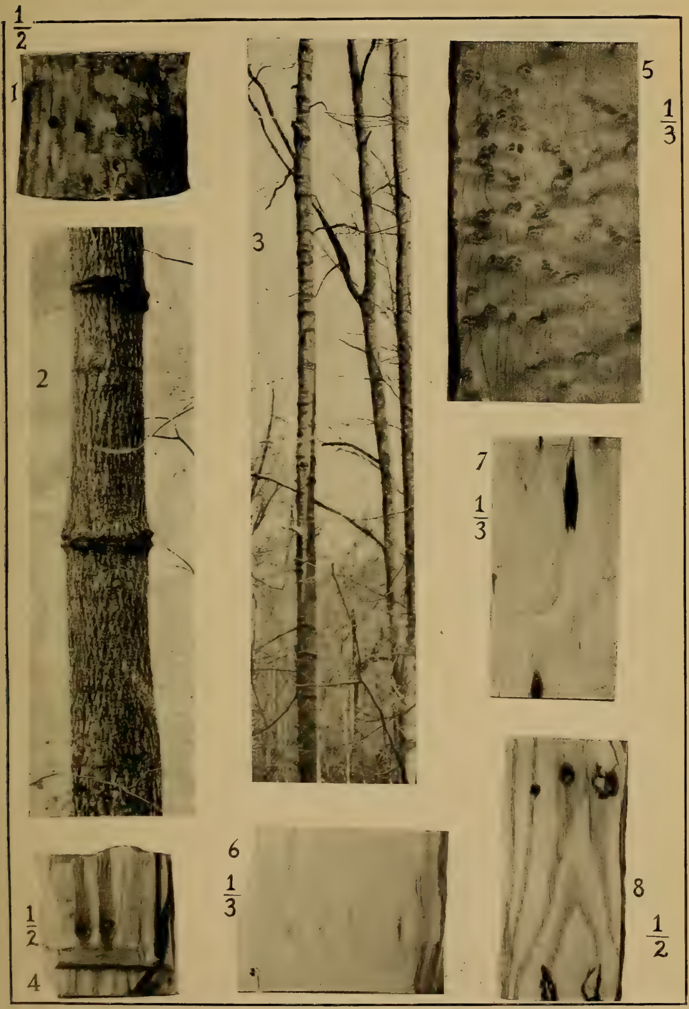


FIG. 18.—Effects of sapsucker work on wood of black walnut (*Juglans nigra*). Holes and dark stains. (From Hopkins.)

The abundance and extensiveness of stains and gnarly growth in hickory unfit the wood for ornamental purposes, and the fact that the iron streaks make the wood harder to work and that checking takes place readily along them, spoils the wood for many of its most important uses. "The wood is heavy, hard, very strong, tough,

PLATE IX.



WORK OF SAPSUCKER ON HICKORY, MAPLE, BASSWOOD, AND CHESTNUT; BIRD'S-EYE.

[1, The beginnings of a girdle on mocker nut. 2, Well-developed girdles, tree 2 feet in diameter. 3, Mocker nut, killed by sapsuckers. 4, Sapsucker pecks and stains in sugar maple wood. 5. Natural bird's-eye in sugar maple. 6, Sapsucker bird's-eye in same wood. 7, Stains due to sapsucker pecking in basswood. 8, Stained knotty checks in chestnut.]

flexible, but not durable in contact with the soil. It is used extensively in the manufacture of carriages and agricultural implements and for ax and tool handles. There is in consequence a good demand for the lumber at a high price."[1] "It is the general impression of the hickory users, . . . that the supply is rapidly diminishing. It is certain that the high grades of hickory required for vehicle parts and for other purposes are being obtained only with increasing difficulty. The average value per thousand feet reported for the lumber is exceeded by only one of the 29 leading species manufactured, namely, walnut."[2] Defects in hickory caused by sapsuckers are specifically mentioned in the Inspection Rules of the Hardwood Manufacturers' Association, where it is stated that the third grade of material is "to consist of the light-weight wood . . . and will admit of small bird pecks, black streaks, and small knots." Hickory wagon and implement stock must be clear with the exception of axles, single and double trees, and neck yokes, "which will admit bird pecks, streaks, and solid knots that will not impair the strength of the piece." A loss of about $20 per thousand feet of lumber is caused by the reduction in grade on account of bird pecks, and the aggregate loss is very large on account of the prevalence of sapsucker work on hickories throughout their ranges. On Plummers Island, Md., 10 of the 34 hickory trees on a certain area bore sapsucker work, and on another area not far distant on the mainland 38 out of 156, a little more than 25 per cent.

Not only do bird pecks occur on a considerable percentage of hickory trees, but they are characteristically abundant on individual trees. Many trees are ringed from top to bottom by sapsucker work, and not infrequently trees are considerably distorted by large girdles.

Mr. A. T. Boisen, formerly of the Forest Service, writes as follows:

> The most serious injury to which the hickories are liable is that known as the "bird peck." . . . The damage done in this way is very extensive, and an immense amount of wood, perhaps as much as 10 per cent of the merchantable material, is left in the woods on account of bird pecks.[3]

Mr. Carlos G. Bates, of the Forest Service, says:

> The damage done by the sapsucker is immense, and may amount to 30 per cent of the total value of the hickories in some localities, and for the entire United States at least 10 per cent.

On the basis of the percentages given by Messrs. Boisen and Bates (and according to the writer's experience their estimates are conservative) the loss to hickory producers of the United States on hickory left standing on account of bird pecks amounts to about $600,000 per year. To this must be added the loss sustained by the producer or lumber dealer on the cut timber graded out by the manufacturers' requirements in regard to bird pecks. The writer has been told of a case where 4½ cords of hickory timber were rejected from a lot of 7 cords by this inspection. Finally, in spite of all the care exercised by the manufacturer to secure perfect stock, bird pecks unnoticed before appear in the finished product (see Pl. XI, fig. 1). In the case of handles at least, this is true of quite a noticeable proportion of the output. Mr. H. A. Tatem, president of the Winston Handle Co., Winston-Salem, N. C., writes as follows:

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[1] Circular 62, Forest Service, p. 2, 1906.

[2] Lumber Cut of the United States in 1907, Bureau of Census, p. 33, 1908.

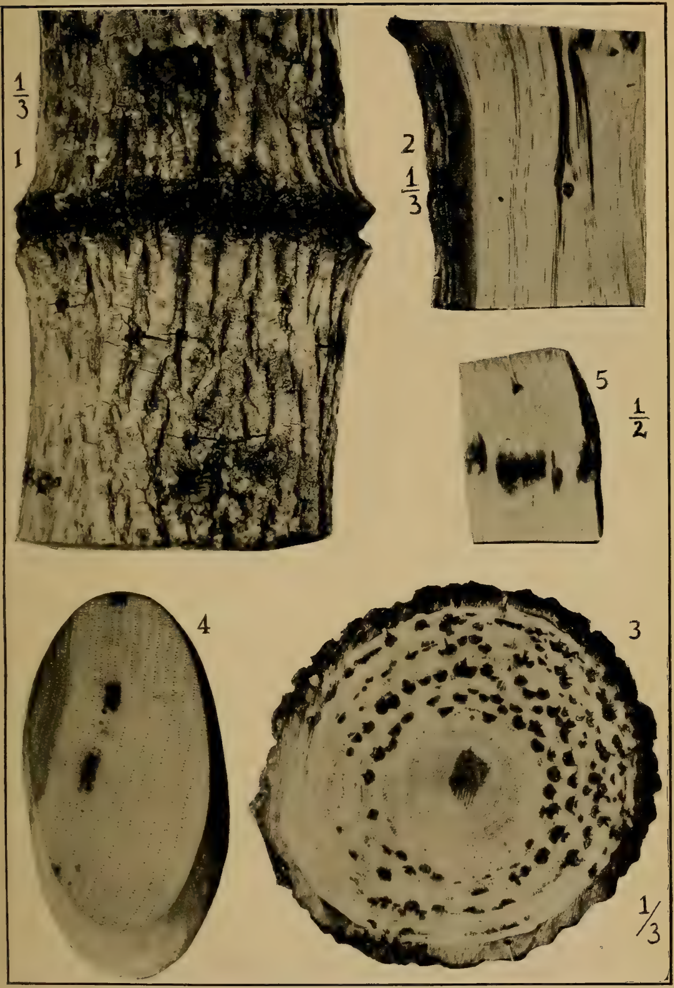
[3] See also Boisen, A. T., and Newlin, J. A., Bull. 80, Forest Service, p. 32, 1910.

> No matter how good the handle, a bird peck generally puts it way below cost. There are many high-class handles with a very slight peck, but down they go. . . . There is no trouble in disposing of them, because they are splendid value for the cost to the consumer. The peck does not injure the handle itself, it is simply defective in appearance.

While we can not agree with the statement that a bird peck never injures a handle, yet our correspondent goes straight to the root of the trouble not only with bird pecks in hickory but in many other woods. Market values depend on appearance more than on quality. However, in the case of hickory the injury is real enough. The gnarly growth caused by the healing of sapsucker wounds is exceedingly objectionable in lumber prized above all things for its straight, clear grain and flexibility. This gnarled condition, as well as the iron streaks which make the quality of the wood fibers uneven, lowers the value of the handles because of the tendency of the grain to rough up or splinter. A member of the Forest Service has stated to the writer that this trouble more than any other would lead him to grade out bird-pecked handles. Uneven quality of the grain is watched for very closely in handles purchased for the Forest Service.

Mocker nut (*Hicoria alba*).—Specimens were collected in Fairfax County, Va., March 21, 1909, from a tree bearing abundant sapsucker work, including several conspicuous swollen girdles (Pl. X, fig. 1). It is clear that the sapsucker when attacking this species punctures one or more layers of sapwood. The excavations do not heal perfectly, but persist as small cavities with radiating fissures, all very darkly stained. A cross section through the tree at the level of one of the protruding girdles (Pl. X, fig. 3) shows many concentric series of stains, evidence that the ring of punctures had been pecked open year after year. Longitudinal sections show the usual appearance of these stains in hickory lumber (Pl. X, fig. 2)—namely, very dark iron streaks up to an inch in width, which extend a foot or more both up and down along the grain. The wood shows a distinct tendency to check or split along the course of the stains.

In a specimen of mocker nut from Cloverdale, Ind., the iron streaks extend through from 10 to 12 annual rings of wood, and checks from the wounds have required the deposition of from 5 to 6 annual rings



Work of Sapsucker on Hickory and Oak.

[1, Near view of a swollen girdle on mocker nut, 2, Radial section through a girdle showing iron streaks. 3, Cross section; checks and iron streaks. 4, Same defects on butt of an ax handle. 5, Stains produced by sapsucker pecking in western white oak.]

to close them. The unusual extent of the stains in this sample suggests that they spread after complete closure of the sapsucker wound, and the specimen gives actual evidence that they do so spread for at least two years after the original peck is entirely healed.

The defects in mocker nut are very conspicuous and objectionable. J. B. Burris, of Cloverdale, Ind., who sent in the last specimen described, writes: "Recently a large sale of the timber was made, but on account of the condition of the trees they were refused as being worthless for lumber. The discolorations . . . sometimes run entirely through the length of a tree, though frequently the lower portion of the tree is free from the markings. . . . Upon inquiry I find that in some localities more than half the hickory trees are affected in this way and thus rendered worthless except for firewood." (Dec. 9, 1901.)

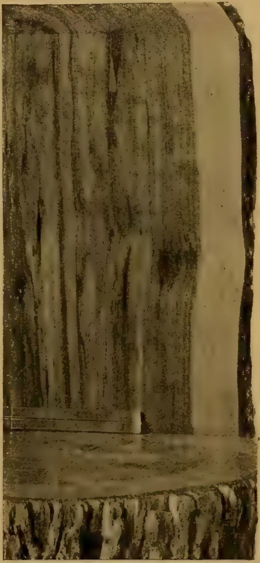


FIG. 19.—Effects of sapsucker work on wood of pecan (*Hicoria pecan*). Knotty checks and iron streaks.

SPECIES OF JUGLANDACEÆ BLEMISHED.—Black walnut (H.), Texan walnut, nutmeg hickory, pecan (fig. 19), Texan pecan, bitter pecan, bitternut (A. A. and A. M. and F.), mocker nut, big shellbark (H.) (fig. 20), southern shellbark, pignut, and woolly pignut.

THE HORNBEAMS AND BIRCHES (BETULACEÆ).

Blemishes in the wood of trees of this family are usually small, consisting of brown stains and sound brown to black checks. In some cases, especially since curly grain and bird's-eye are often present, the effect is ornamental (fig. 21), but probably ornaments as well as defects are of no economic importance in the hornbeams. No serious defects have been found in the birches.

SPECIES OF BETULACEÆ BLEMISHED.—Hornbeam (H. and A. A.) (fig. 21), hop hornbeams (*Ostrya virginiana* and *Ostrya knowltoni*), canoe birch, and sweet birch (according to Dr. Hopkins).

THE BEECHES, CHESTNUTS, AND OAKS (FAGACEÆ).

The woods of this family are more widely used than those of any other deciduous trees. They are valuable for general construction, cooperage, interior finish, and cabinetmaking, for which purposes the wood must be sound, and for the latter two uses have few blemishes. Many of the species are attacked by sapsuckers, and the resulting defects in the wood are serious. Defects have been found in the beech, chestnut, and chinquapin, and in all they are detrimental to the appearance of the wood, and in small pieces they diminish the strength. Ornamental curled grain is sometimes produced in beech, but black cavities and extensive brown stain also are formed, which counterbalance the good effect of the desirable grain. In chinquapin and chestnut (fig. 22 and Pl. IX, fig. 8) large open checks result from sapsucker work, which seriously blemish and weaken the wood.

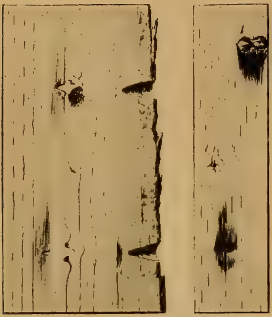


FIG. 20.—Effects of sapsucker work on wood of big shellbark (*Hicoria laciniosa*). Stains and gnarly growth. (From Hopkins.)

In oak, sapsucker blemishes or bird pecks are almost invariably open knotty checks, sometimes small but usually half an inch square or larger. The checks and the immediately adjoining wood are usually heavily stained and the checks are sometimes partly filled or surrounded by loose soft or rotten wood. The wood over the defects is more or less stained and distorted. Checking through the blemishes commonly occurs, and the weakening of the wood is further shown by the tendency of windshakes to occur along the line of sapsucker injuries. Defects have been observed in the wood of 19 oaks, in 17 of which they are serious enough to cause marked loss in value of woods so prized for furniture, interior finish, and other ornamental uses, and in 2 of which, black oak (fig. 23) and cow oak (fig. 24), they are so large as to spoil the wood for any but the coarsest construction. The large, open, knotty checks so characteristic of sapsucker work

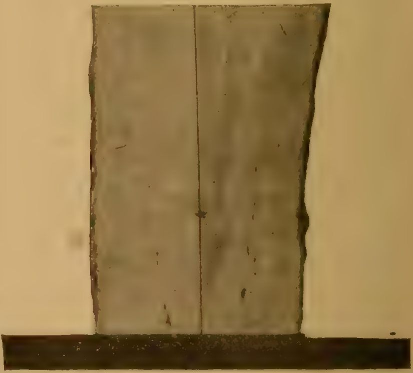
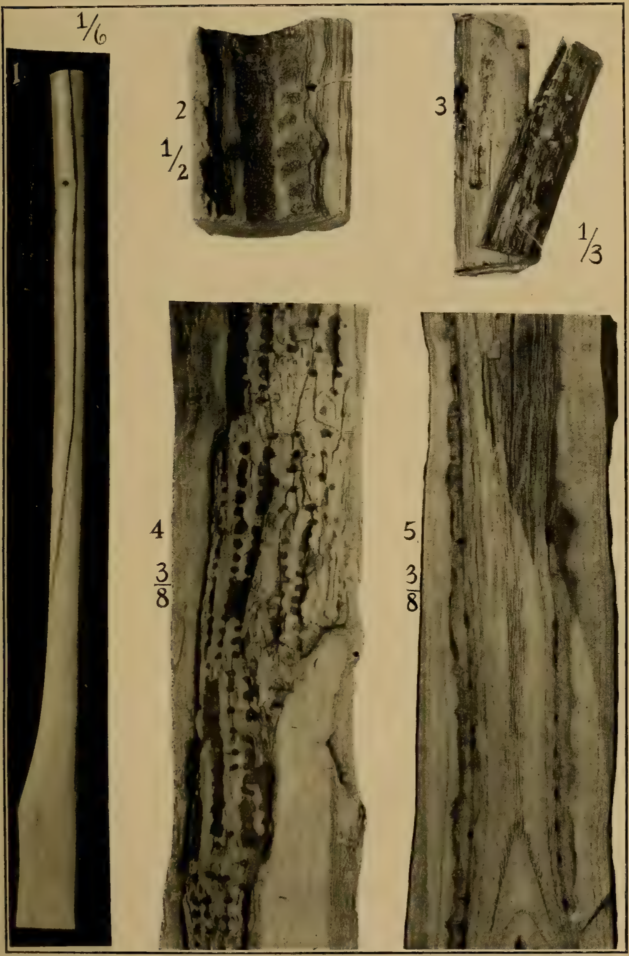


FIG. 21.—Effects of sapsucker work on wood of hornbeam (*Carpinus caroliniana*). Small checks and stains.



Work of Sapsucker on Hickory, Pitch Pine, Red Cedar, and Sassafras.

[1, Checks and iron streak in hickory handle. 2, Stains and resin deposit in pitch pine. 3, Stain, resin deposit, and tubercles in red cedar. 4, Sassafras, partly killed by sapsucker pecking and healing over. 5, Longitudinal section of same; checks and stains.]

in oak (present in specimens of 14 of the 19 species examined) effectually spoil the wood for tight cooperage, one of its most valuable uses.

White-oak lumber is extensively used for ornamental purposes and yields the largest returns when so used. It is very carefully graded, and the inspection rules of the National Hardwood Lumber Association specify that "stains and streaks in oak are a serious defect, and inspectors are cautioned to be careful in estimating their damage to pieces, as ofttimes they will reduce them below the grade of firsts and seconds." Reduction in grade means the loss of about 30 per cent from the best selling price. A great deal of white oak is cut into veneers for finishing purposes, and knots and stains are very objectionable. At a veneer plant in Winston Salem, N. C., visited by the writer, all the material showing sapsucker work was found among the lowest grade or cull stuff. Although the cause of the defects was unknown to the millmen, it was evident that blemishes due to sapsucker work are incompatible with high quality in white-oak veneer.

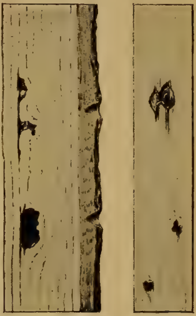


Fig. 22.—Effects of sapsucker work on wood of chestnut (*Castanea dentata*). Large gnarly checks. (From Hopkins.)

Beech (*Fagus grandifolia*).—A piece of this wood which is not large enough to include the original wounds shows a distinct curl in the wood. The bark has healed with a strong inward projection, which has produced a depression in each new wood layer. The original sapsucker holes were from a fourth to half an inch apart, but the ridge on the inner side of the bark is continuous, with slightly elevated tubercles under the punctures. In such a case, if the sapsucker work is old and many annual rings have been curled, so that the stains can be avoided in sawing the wood, the effect of the bird's work is to enhance the value of the wood for ornamental purposes. However, unless these conditions are met, ornamental features do not mitigate the effect of certain blemishes that are produced. Gnarly growth takes place at the original wound, which is only partly filled and is surrounded by very black stain. A lighter brown stain also extends some distance along the grain. These blemishes are so decided that they would certainly be cause for lowering one or more grades the lumber cut from this tree. (Specimens from Morgantown, W. Va.)

Chestnut (*Castanea dentata*).—Sapsucker work in chestnut produces large (three-fourths by one-fourth inch) cavities, black stained, and partly filled by loose, black, knotty growth (fig. 22 and Pl. IX, fig. 8.) The wood is weakened by these cavities, as is shown by its checking on a line with them. For cabinet or other work requiring sightliness, or where strength is required in any but large pieces, chestnut with abundant sapsucker work would be useless. (Specimens from Pickens, W. Va.)

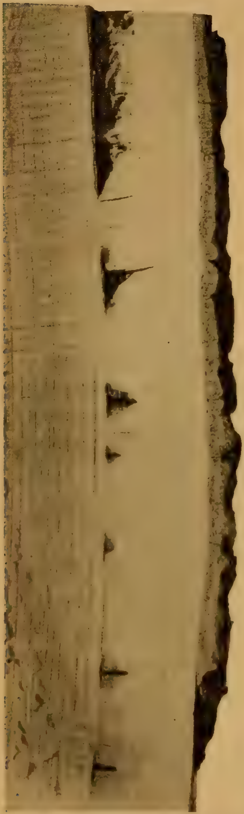


FIG. 23.—Effects of sapsucker work on wood of black oak (*Quercus velutina*). Large gnarly checks.

Black oak (*Quercus velutina*).—The defects produced in this tree by sapsucker pecking are large, widely open, black-walled checks surrounded by much gnarled and stained wood (fig. 23). These checks vary in size up to 1 by ½ by 5 inches and constitute defects so extreme that the lumber is useless for any structural purpose. (Specimens from Abbeville, La.)

Cow oak (*Quercus michauxi*).—The defects produced in this wood are large to very large black gnarly checks. These are sometimes contiguous, forming a stained crack following an annual ring (fig. 24), 4 inches horizontally and 2 to 3 inches vertically. Open fissures extending toward the bark and surrounded by much gnarly wood are characteristic. The wood under the wounds is usually soft and rotten. The specimens examined show that windshakes tend to occur along the line of sapsucker defects. The blemishes are large and numerous, hence serious. Many windfallen trees examined by the writer at Abbeville, La., were so filled with defects that they would not afford a single board of marketable dimensions. The wood is useless except for fuel.

Colorado white oak (*Quercus leptophylla*).—Numerous open knotty checks stained dark brown occur in a trunk of this species attacked by sapsuckers. They are surrounded by gnarly wood, and some are one-half inch by 1 inch in size, being equivalent to open knots of those dimensions. When several occur along the same wood layer they constitute a line of potential fracture, thus rendering the trunk more liable to injury by wind-shake. (A. A. and A. M. 301.)

Species of Fagaceæ blemished.—Beech, chinquapin, chestnut, tanbark oak, turkey oak, black oak (fig. 23), Texan oak, Spanish oak, water oak (Santee Club, South Carolina), laurel oak, white live oak (fig. 25), live oak (Santee Club, South Carolina; Glen Rose, Tex., fig. 26), net-leaf oak (A. A.), Texan white oak, shin oak (fig. 27), Chapman oak, chestnut oak (Seven Locks, Md.), cow oak (fig. 24), western white oak (Pl. X, fig. 5), Colorado white oak, post oak (Longbridge, La.), and white oak (H.).

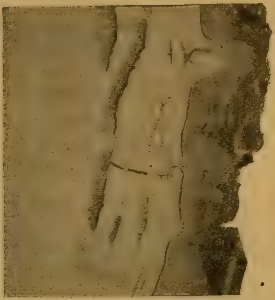


FIG. 24.—Effects of sapsucker work on wood of cow oak (*Quercus michauxii*). Stained and soft-walled checks.

THE ELMS AND HACKBERRIES (ULMACEÆ).

Defects due to sapsuckers have been noted in the wood of six kinds of elms (including water elm), in three of which they are serious, and in two species of hackberry, one of which is much blemished. The defects vary from light brown stains of no economic significance to black checks, sometimes large and often filled with loose or soft woody tissue.

All of the elms furnish wood of commercial importance, and sapsucker work reduces its value or spoils it for such representative uses as the wooden parts of agricultural implements and vehicles, cooperage, and furniture. Hackberry wood is sometimes used for furniture, for which sapsucker defects unfit it.

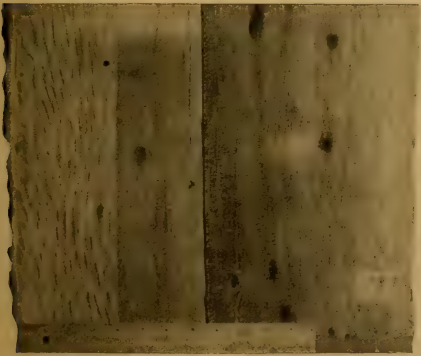


FIG. 25.—Effects of sapsucker work on wood of white live oak (*Quercus chrysolepis*). Knotty checks.

WHITE ELM (*Ulmus americana*).—Healed sapsucker wounds in this tree vary from small cavities partly filled with powdery tissue to large open knots, sometimes an inch or more in length and involving three to four annual layers of wood (Pl. VIII, fig. 2). These knots, as well as the wood immediately surrounding them, and sometimes for some distance along the grain, are black stained. When sapsucker work is abundant, the whole body of the wood is sprinkled with stains, the grain is gnarled and in some cases (Pl. VIII, fig. 1) strongly bent outward, and the wood is unfit for any of the ordinary uses of the lumber except fuel or coarse construction. (Specimens from near Scotts Run, Fairfax County, Va.)

Slippery elm (*Ulmus fulva*).—The defects resulting from moderate sapsucker work are short (one-fourth to one-half inch) wavy checks surrounded by black stain extending up to one-half inch both vertically and horizontally on the surface of the wounded annual ring, and by light brown stain for a much greater distance. The stains penetrate the wood under the wounds. Where several pecks are close together, the defects are much worse, being open knotty checks up to 1½ square inches and with open fissures extending one-half inch or more toward the bark (fig. 28). These large defects are stained black and are surrounded by brown stain extending 4 inches or more. The grain is curled over the pecks. The blemishes seriously affect both strength and beauty. (Specimens from Longbridge, La.) A trunk from Missouri (A. M., 278) contains small black checks and brown stains resulting from sapsucker work.

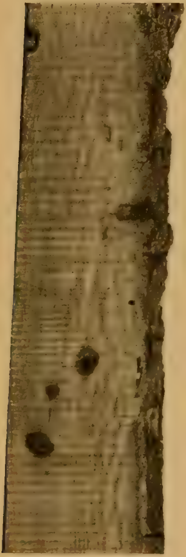


Fig. 26.—Effects of sapsucker work on wood of live oak (*Quercus virginiana*). Loose knots and stain.

Hackberry (*Celtis mississippiensis*).—Healed sapsucker punctures in this species appear as transverse dark brown stains from which lighter brown stains run several inches both up and down the grain, and from which also open checks, more or less filled with easily removable soft tissue, extend toward the bark for varying distances up to an inch (fig. 29). These checks are from one-fourth to one-half inch wide. The defects injure the lumber in both appearance and strength. (Cottonport, La., Feb. 14, 1910.)

Species of Ulmaceæ blemished.—Rock elm, winged elm, white elm, slippery elm, water elm (A. M.), *Celtis occidentalis* (F.), and *Celtis mississippiensis*.

THE FOUR O'CLOCK FAMILY (NYCTAGINACEÆ).

The wood of blolly (*Torrubia longifolia*), the only native tree of this family, is sometimes blemished by small open knotty checks with little stain but much gnarly grain.

THE MAGNOLIA FAMILY (MAGNOLIACEÆ).

Small, intensely black stains, the effects of which are confined to the wood immediately adjoining the original injury, result from sapsucker work in bull bay (Longbridge, La.), the only defective magnolia wood examined; and long black stains following the grain are produced in the tulip tree, one of the most useful of our native trees. These blemishes unfit the lumber for its most profitable uses.

TULIP TREE, YELLOW POPLAR, OR WHITEWOOD (*Liriodendron tulipifera*).—Tulip trees are very commonly worked on by sapsuckers and frequently are covered with girdles and single punctures from top to bottom. In the healing of sapsucker wounds, inward projections are usually formed on the inner side of the bark, and when close together they combine into a low irregular ridge. These elevations cause depressions in the succeeding annual rings and a curly condition of the grain which in tangential section appears as bird's-eye (Pl. XII). This is often abundant in yellow poplar and enhances the beauty of the wood. Bird's-eye is, however, accompanied by holes and stains resulting from the original wounds, and while some pieces showing bird's-eye and not the defects can be secured from every tree showing sapsucker work, probably the proportion of such boards or veneer from any tree is not large. To have the greater part of the wood ornamented and at the same time free from sapsucker defects would require that the tree be liberally punctured in one or a few successive years and left untouched thereafter. But this is not the way sapsuckers usually work. Favorite trees are moderately pecked year after year for a long time; hence stains are produced throughout the wood. If a tree is only sparingly pecked for one or a few years, the ornamental effects will be inconsiderable, and if vigorously attacked during a similar period it is likely to die. On the whole, therefore, probably not many tulip trees can be found in which the wood shows many of the favorable results of sapsucker

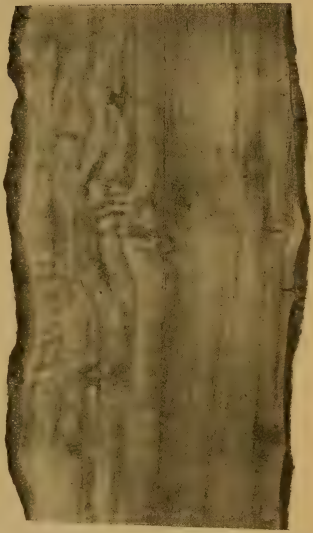


FIG. 27.—Effects of sapsucker work on wood of shin oak (*Quercus undulata*). Checks, stain, and gnarly grain.

work and few of the accompanying blemishes. The matter is of no consequence in wood intended for crates, boxes, and composition boards. But tulip lumber figures extensively as a finishing material, often being stained to imitate mahogany. The writer has gone over much tulip veneer, and can state with confidence that the percentage of material showing blemishes from sapsucker work is considerable.

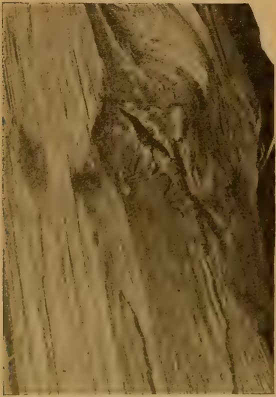


Fig. 28.—Effects of sapsucker work on wood of slippery elm (*Ulmus fulva*). Large check and stains.

THE PAWPAWS AND POND APPLES (ANONACEÆ).

A large sapsucker peck in the wood of one specimen (A. M.) of pawpaw is not healed but is filled with an intensely black deposit.

THE LAUREL FAMILY (LAURACEÆ).

The three species of this family in the wood of which blemishes due to sapsuckers have been noted are all seriously affected. The defects observed in the three species have little in common except a tendency to extensive lateral staining around the injured wood rings.

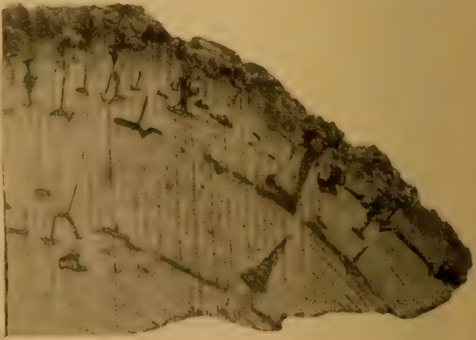
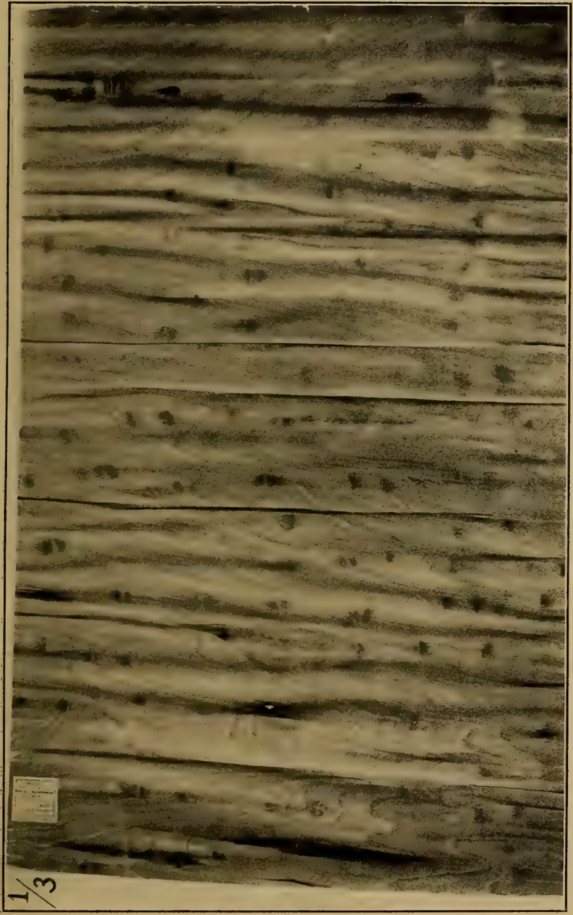


Fig. 29.—Effects of sapsucker work on wood of hackberry (*Celtis mississippiensis*). Stains and loosely filled checks.

Red bay (*Persea borbonia*).—A large proportion of red bay trees are vigorously attacked by sapsuckers, and the resulting blemishes are severe. Gnarly open cavities are produced, accompanied by dark brown or black stains which extend far along the grain and are sometimes continuous around the wood rings (fig. 30). Many of the wounds take 15 to 20 years to heal, producing open fissures extending outward an inch or more. These fissures may be half an inch long vertically

PLATE XII.



WORK OF SAPSUCKER ON TULIP TREE.

[Stains and bird's-eye.]

and are walled by soft wood. The stains are heavy and may penetrate one or two layers of wood beneath and five to ten or more layers over the wounds. These defects are exceedingly objectionable and unfit the wood for its limited use in carpentry.

Sassafras (*Sassafras variifolium*).—The specimen examined is from a tree one side of which had been killed by sapsucker pecking and is now partly covered by new growth. As the wounds themselves have not healed, their appearance where buried by succeeding layers of wood is unusual. Along the plane of separation of the new and dead wood are long series of partly filled blackened pecks, with stain all along the line (Pl. XI, fig. 5). The wood covering the pecks is gnarled and full of stained cracks and is worthless for any constructive purpose.

California laurel (*Umbellularia californica*). — Defects resulting from sapsucker work are conspicuous black checks accompanied by extensive lateral staining and much gnarly wood. They are highly objectionable in this valuable wood.

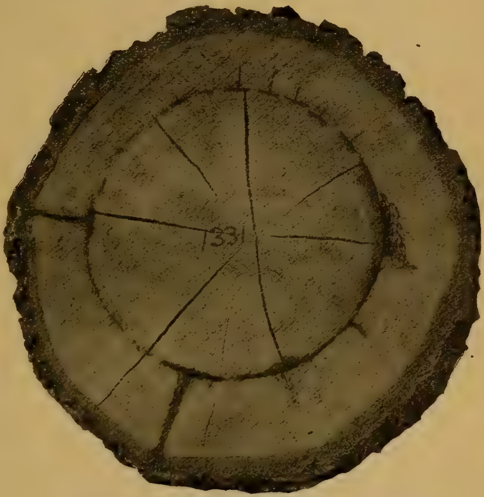


Fig. 30.—Effects of sapsucker work on wood of red bay (*Persea borbonia*). Stains, checks, and long fissures.

THE SWEET GUM FAMILY (ALTINGIACEÆ).

The wood of the single native species of this family is injured by sapsuckers.

Sweet gum (*Liquidambar styraciflua*).—In a specimen from Abbeville, La., transverse black stains three-eighths inch wide surround the healed punctures, from which brown stains penetrate the grain vertically half an inch each way. These blemishes are objectionable from an ornamental standpoint but not materially so otherwise. In a trunk from the Santee Club, South Carolina, besides stains which are peculiar in that they lie mostly in the two to three layers of wood beneath the wounds, more or less open checks are formed, varying in size up to half an inch square and filled with the white crystallized sap. These blemishes are numerous and seriously decrease the usefulness of the lumber. The wood is valuable, often being substituted for black walnut.

THE SYCAMORES (PLATANACEÆ).

Defects due to sapsucker pecking have been observed in the wood of two (*Platanus occidentalis* and *P. racemosa*) of the three native sycamores. They are small brown checks and stains and are of no economic importance.

THE ROSE FAMILY (ROSACEÆ).

The few arborescent species of this family are not highly valued for their wood, but are used to a small extent for turned articles. The defects produced by sapsuckers, varying from small to large open knotty checks heavily stained, unfit them for this use.

MOUNTAIN MAHOGANY (*Cercocarpus ledifolius*).—Sapsucker punctures produce very serious blemishes in the wood—open, knotty, black-walled cavities, some with crystalline sap deposit. Some of these are fully an inch long, and in many cases a large black fissure extends from them toward or even entirely to the bark, through many annual layers of wood. The lumber is ruined as to both beauty and strength (Eureka, Cal., A. A. 202).

SPECIES OF ROSACEÆ BLEMISHED.—*Vauquelinia californica*, *Cercocarpus betuloides*, *C. breviflorus*, and *C. ledifolius*.

THE APPLE FAMILY (MALACEÆ).

Wood of the trees of this family is usually hard and tough and is used to a small extent for mallets, tool handles, and turnery. The defects produced by sapsuckers, when pronounced, make it useless for such purposes, as they increase liability to splitting. They vary from small brown or black stains to large open checks and fissures.

CALIFORNIA HOLLY (*Heteromeles arbutifolia*).—Trunks of this species collected in California (A. A. and A. M. 235) contain conspicuous defects due to sapsuckers (fig. 31). These are large knotty cavities, deeply stained and surrounded by much gnarly growth, with long fissures partly or wholly filled with black-stained or white soft growth extending toward the bark. These checks or fissures sometimes exceed an inch in length. The wood is so distorted and blemished as to be useless except for fuel.

SPECIES OF MALACEÆ BLEMISHED.—*Malus angustifolia* (A. M.), *Malus diversifolia*, California holly, *Crataegus crusgalli*, *C. lacrimata*, *C. opima*, *C. berlandieri*, *C. boyntoni*, *C. collina*, *C. texana*, *C. mollis*, and *C. marshalli*.

THE PLUM FAMILY (AMYGDALACEÆ).

Defects caused by sapsuckers have been observed in the wood of seven species of this family. Not all these species have great economic value, but the wild black cherry furnishes one of our most costly woods. The blemishes in it are typical of those in this family, and they are sometimes so serious as to ruin the wood for any ornamental use.

WILD BLACK CHERRY (*Padus serotina*).—In specimens from southern Arizona (A. A. and A. M. 188) sapsucker defects vary from small to large black checks accompanied by little stain. Specimens from Randolph County, W. Va. (H. 6801a), show large stains up to 1½ inches long and varying from yellowish brown to black about the healed wounds. The injuries evidently do not heal readily, as cavities surrounded by gnarly growth are formed. Defects in cherry, which is used almost exclusively for ornamental purposes, are very objectionable. Such as are here described would certainly lower the grade of lumber, causing a loss of perhaps 75 per cent from the best selling price.

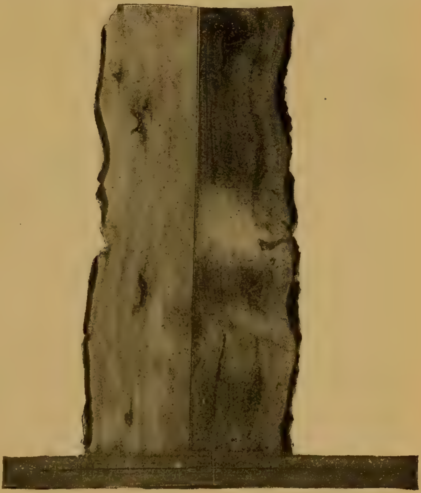


FIG. 31.—Effects of sapsucker work on wood of California holly. (*Heteromeles arbutifolia*). Knotty checks, gnarly grain, stain, and long fissure.

SPECIES OF AMYGDALACEÆ BLEMISHED.—Hog plum, wild goose plum, garden plum (F.), bitter cherry, western chokecherry, wild black cherry, and islay.

THE SENNA FAMILY (CÆSALPINACEÆ).

Blemishes caused by sapsuckers have been noted in but one species of this family—the honey locust.

Honey locust (*Gleditsia triacanthos*).—Brown stains penetrating the injured wood layer are developed at the healed wounds, and they are often continuous around the annual ring. In such a case the layer constitutes a potential line of fracture. Many stains are accompanied by open fissures extending outward. These defects are occasionally enlarged by much subsequent pecking until large, ramifying, open, black-stained cavities result. The exterior of the tree is disfigured by large swollen girdles, and the wood in the girdles is gnarled and so full of checks and stains (figs. 32 and 33) that it is useless, except for fuel.

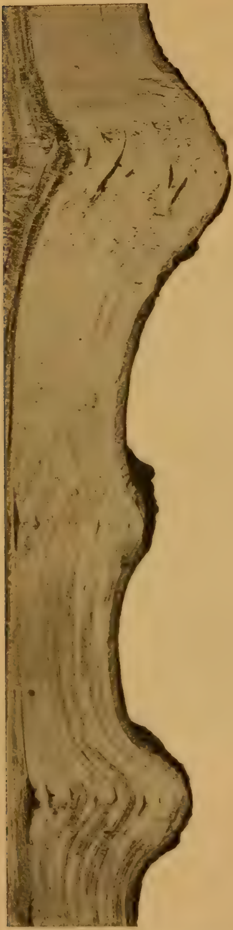


Fig. 32.—Effects of sapsucker work on wood of honey locust (*Gleditsia triacanthos*). Longitudinal section. Checks, stains, and gnarly grain.

THE RUE FAMILY (RUTACEÆ).

But one species of this family is known to be injured by sapsuckers, but it is the valuable satinwood (*Xanthoxylum flavum*), which is largely used for furniture and tool handles. Objectionable long dark stains are produced.

THE MAHOGANY FAMILY (MELIACEÆ).

The single native species of this family, mahogany, a cabinet wood of the highest value, is seriously blemished by sapsuckers.

Mahogany (*Swietenia mahagani*).—The wood is heavily stained around the original wounds and a lighter stain extends to a considerable depth and far along the grain. Cavities partly filled with brittle black material are formed, and gnarly growth characterizes the wood in the immediate vicinity of the wounds. Curly wood and a large bird's-eye are present in many annual rings succeeding the injury. Both defects and ornaments are produced in this wood, but to get the benefit of the latter the logs must be sawn with reference to the sapsucker work. As this is not practicable commercially, the blemishes probably overbalance the embellishments.

THE SUMAC FAMILY (ANACARDIACEÆ).

The wood of one native and one introduced species of this family is blemished by sapsuckers. The matter is of no economic importance except possibly in the case of the introduced pepper tree. Mr. W. Otto Emerson, of Haywards, Cal., contributes the following note on this species: "I have two old pepper trees beside the house where [the red-breasted sapsucker] has left his marks from year to year. In time this cutting of the bark of the pepper tree causes an enlargement of the limb all around where the holes are; the same occurs in the blue-gum tree, and ruins the wood for commercial purposes."

SPECIES OF ANACARDIACEÆ BLEMISHED.—Smoke tree and pepper tree.

THE HOLLY FAMILY (AQUIFOLIACEÆ).

The wood of three species of holly is known to be blemished by sapsuckers. In two of them greenish brown to black checks and pronounced stains spoil the appearance of the wood for pyrography, one of its most important uses. The checks and fissures produced are objectionable in holly wood used for turnery, because they render it liable to splitting.

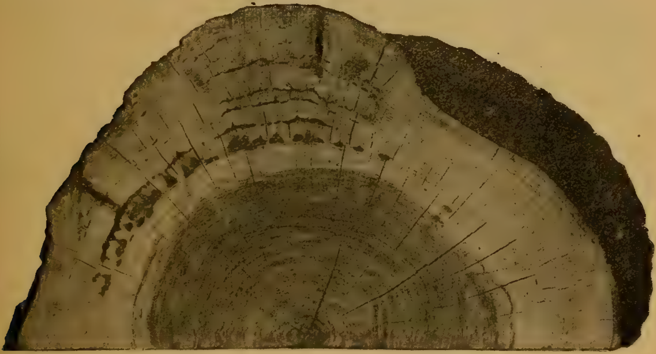


FIG. 33.—Honey locust. Cross section through a girdle. Checks, stains, and gnarly grain. The two long elliptical black marks are nail holes.

HOLLY (*Ilex cassine*).—Healed sapsucker wounds in this wood are marked by large black stains which tend to be continuous around the injured wood ring. Fissures extend outward from the old pecks, some being open, although three-fourths of an inch of wood has formed outside the punctured layer. These fissures are soft-walled and cause much distortion in the surrounding wood. (Fig. 34.) The defects are very serious and render the wood useless except for fuel (Longbridge, La.).

SPECIES OF AQUIFOLIACEÆ BLEMISHED.—Youpon, *Ilex opaca* (Abbeville, La.), and *Ilex cassine*.

THE MAPLE FAMILY (ACERACEÆ).

Defects due to sapsuckers have been observed in the wood of five species of maples, in three of which they are objectionable and may cause lowering of the grade of lumber. The defects vary from small to large brown stains, sometimes accompanied by long lighter stains and by ornamental curled grain and bird's-eye (figs. 9 and 10 and Pl. IX, figs. 4 and 6). They have been fully discussed in one species, the sugar maple, on pages 58–61.

SPECIES OF ACERACEÆ BLEMISHED.—*Acer rubrum* (A. M. and F.), *A. drummondi*, sugar maple, black maple, and box elder (Fairfax County, Va., and Longbridge, La.).

THE BUCKEYE FAMILY (ÆSCULACEÆ).

One species is known to be markedly blemished.

OHIO BUCKEYE (*Æsculus glabra*).—A sample of bird-pecked buckeye shows a large stain, and the wound has not been closed by a year's growth. This indicates that conspicuous defects result from sapsucker work in this wood. Buckeye has not long been put to important uses, but its easy working qualities and beauty are sure to create a greater demand for it. It is even now largely used for pyrography, for which no stained wood can be sold.

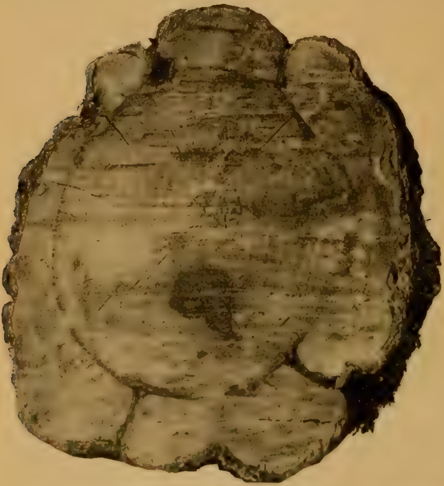


FIG. 34.—Effects of sapsucker work on wood of holly (*Ilex cassine*). Stains and soft-walled fissures.

THE BUCKTHORN FAMILY (RHAMNACEÆ).

In the wood of two small trees of this family sapsuckers are known to produce defects varying from small dark brown stains to large stains and knotty cavities. The woods have no commercial importance.

SPECIES OF RHAMNACEÆ BLEMISHED.—Cascara sagrada and California lilac.

THE BASSWOOD FAMILY (TILIACEÆ).

Defects consisting of large open checks and black stains (Pl. IX, fig. 7), due to sapsucker pecking, have been observed in the wood of three species of this family. They are serious in all, and either lower the grade of the lumber or spoil it for all uses except fuel.

Basswood, often called whitewood, is used for panel work, woodenware, trunks, and other purposes where whiteness is desirable. The inspection rules of the National Hardwood Lumber Association particularly note that "black spots or streaks are a serious defect and inspectors must be careful in estimating their damage. If they are excessive they will reduce the piece one or more grades." Furthermore, a great deal of basswood lumber is used for pyrographic material, in which no stains are permissible. Thus sapsucker work in basswood trees that are to be converted into lumber keeps the product out of the best grades. A loss of about 25 per cent results for each grade the lumber is reduced.

In some localities basswoods are favorite trees of the sapsuckers, as for instance on Plummers Island, Md., where three out of five are attacked. In Rockfish Valley, Va., also, the writer noted a large proportion of basswood barrel heads showing sapsucker defects. It is possible therefore that losses due to bird pecks in basswood may at times be heavy.

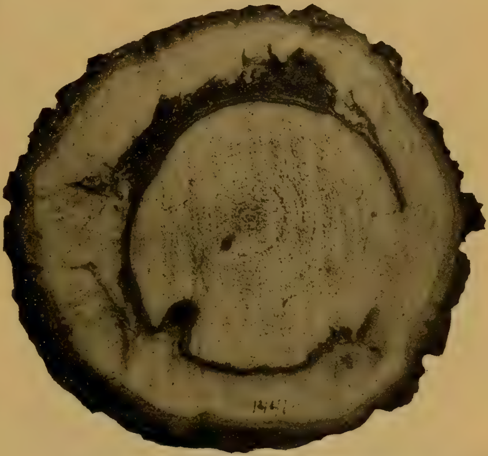


Fig. 35.—Effects of sapsucker work on wood of basswood (*Tilia pubescens*). Stain and extensive gnarly checks.

Basswood (*Tilia pubescens*).—In samples from Abbeville, La. (fig. 35), black stains impregnate the punctured wood ring and are so extensive as usually to be contiguous around it; they extend an inch in each direction vertically from the wound. Large open black-stained checks result, some extending toward the bark through several annual rings. These defects are very serious and no good lumber could be sawn from a trunk so defective.

Species of Tiliaceæ blemished.—*Tilia americana* (H. and F.) (Pl. IX, fig. 7), *T. michauxii*, and *T. pubescens*.

THE FREMONTIA FAMILY (CHEIRANTHODENDRACEÆ).

The wood of the single native species (*Fremontodendron californicum*) is blemished by small black checks up to half an inch in length.

THE WHITE MANGROVE FAMILY (COMBRETACEÆ).

Defects due to sapsucker punctures are known in two of the three native species of this family. In the buttonwood (A. A.) the blemishes are small brown to black checks with short reddish streaks in the wood. In the black olive tree the sapsucker holes are drilled deep into the sapwood, and are either healed by the intrusion of long plugs from the overlying new wood layer or remain open. These defects may be accompanied by more or less dark stain. The wood of this tree is valued for construction, but it is doubtful whether much loss results from bird pecks.

THE MYRTLE FAMILY (MYRTACEÆ).

W. Otto Emerson, of Haywards, Cal., states that the cutting of the bark of the blue gum (*Eucalyptus globulus*), an introduced tree of this family, by the red-breasted sapsucker in time causes an enlargement of the limb all around and ruins the wood for commercial purposes.

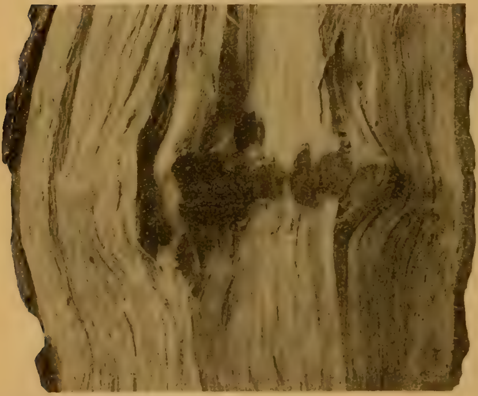


FIG. 36.—Effects of sapsucker work on wood of flowering dogwood (*Cynoxylon floridum*). Large stains and gnarly grain.

THE DOGWOOD FAMILY (CORNACEÆ).

Blemishes produced by sapsuckers have been noted in the wood of three species of this family, in one of which, the flowering dogwood, they are very objectionable.

FLOWERING DOGWOOD (*Cynoxylon floridum*).—The stains are from dark reddish brown to black and are extensive, sometimes forming a continuous band half an inch wide around the annual rings (fig. 36). The wood is strongly bent outward over the healed wood and is very gnarly. The defects are sufficient to keep the wood out of the market, as only perfect pieces are used for such purposes as turnery, carving, and engraving. (Specimens from Cottonport, La.)

SPECIES OF CORNACEÆ BLEMISHED.—Tupelo gum, cornel, and flowering dogwood.

THE HEATH FAMILY (ERICACEÆ).

The wood of two species of this family is known to be blemished by sapsuckers, the defects varying from small to very large stained checks. The woods are, however, little used.

Species of Ericaceæ blemished.—Sourwood and madrona.

THE HUCKLEBERRY FAMILY (VACCINIACEÆ).

The single native arborescent species is badly blemished by sapsuckers.

Tree huckleberry (*Batodendron arboreum*).—A moderate amount of sapsucker work in this wood results in very dark brown stains, which run far along the grain and in open checks up to an inch in length. Under vigorous sapsucker attack patches of bark are killed, and the healing being slow the exterior of the tree is considerably distorted by swollen girdles and disfigured by pits and exposed patches of deadwood or bark. The wounds are marked by deep black stains or often by open checks. The latter extend toward the bark and many of them have remained 10 years unhealed (fig. 37). These checks are soft-walled, irregular, and black-stained, and the unclosed ones show patches of dead and discolored wood or bark up to 2½ inches in diameter. These blemishes make the wood useless for any but the coarsest construction or for fuel. (Specimens from Cottonport and Longbridge, La.)

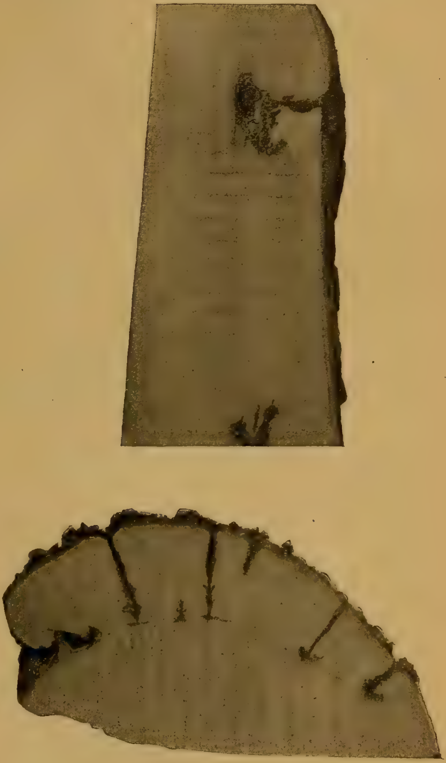


Fig. 37.—Effects of sapsucker work on wood of the tree huckleberry (*Batodendron arboreum*). Longitudinal and cross sections. Stained open checks and fissures.

THE SAPODILLA FAMILY (SAPOTACEÆ).

The wood of two species of this family, the southern and Arizona buckthorns, is known to be affected by sapsucker work. The checks are small and round and much curled grain overlies the healed wounds; hence the effect is to embellish the wood.

THE EBONY FAMILY (EBENACEÆ).

One of the two native trees of this family is known to be blemished by sapsuckers. The defects in persimmon are oblong deep black stains, not extending along the grain. They mar the appearance of the wood, but do not injure it for its ordinary commercial uses (Cottonport, La.).

THE OLIVE FAMILY (OLEACEÆ).

Defects due to sapsuckers have been observed in three species of this family, one of which is the unutilized devilwood, the other two being ashes, both valuable timber trees.

Some of the original wounds in ash persist as cavities only partly filled with loose woody tissue surrounded by conspicuous stains. These blemishes would lower the grade of ash wood, as it is especially prized for its usual freedom from blemishes. In ash lumber used for vehicles and for wooden parts of agricultural implements and machinery, strength is the prime requisite; but for such purposes pieces containing the small open knots resulting from sapsucker work would have to be discarded. Ash is used also for paneling and ornamental purposes. Both blemishes and ornaments appear in the samples examined, but the presence of a few small ornaments by no means prevents the rejection or degrading of a piece for defects. Occurring together, as they always do, the blemishes, which we do not want, overbalance the ornaments, which we can do without.

White ash (*Fraxinus americana*).—The defects in a specimen from Cottonport, La., are knotty checks surrounded by oblong brown stains. Lighter stains extend along the grain 6 inches or more. Curled grain and bird's-eye are abundant, but being associated with the defects have no importance. In samples of white ash from Abbeville, La., the stains tend to be continuous around the annual rings and penetrate one or two wood layers both over and under the wounded one. More or less open checks remain, some containing loose woody tissue, and the surrounding wood is quite gnarled. These defects are objectionable from an ornamental standpoint and also as to strength in the case of small pieces.

Two specimens of shovel handles are at hand showing the appearance of sapsucker defects in articles manufactured of white ash. One, obtained at Evansville, Ind. (II.), shows scars left by seven of a series of sapsucker pecks. The bird evidently had drilled through one and in places two layers of sapwood, and the resulting cavities were partly filled by invaginations of wood from the succeeding annual ring. Each of these invaginated plugs is split and gnarly. The wood surrounding the partly filled holes is stained through from two to four annual rings. The other handle, from Marion, Ind., contains small black slightly open checks with light stains extending some distance along the grain. Only checks are present, but the handle had been placed in the lowest grade.

SPECIES OF OLEACEÆ BLEMISHED.—Black ash, white ash, and devilwood (A. A.).

THE TRUMPET CREEPER FAMILY (BIGNONIACEÆ).

Two trees of this family are slightly blemished by small brown stains and checks due to sapsucker pecking, but the injury is probably of no economic importance.

SPECIES OF BIGNONIACEÆ BLEMISHED.—Hardy catalpa (A. A. and A. M.) and desert willow.

THE HONEYSUCKLE FAMILY (CAPRIFOLIACEÆ).

Blemishes varying from small black checks to large open knotty black cavities due to sapsuckers have been noted in the wood of two trees of this family.

SPECIES OF CAPRIFOLIACEÆ BLEMISHED.—*Viburnum lentago* (A. A.) and *V. prunifolium*.

SUMMARY OF BLEMISHES AND ORNAMENTAL EFFECTS IN LUMBER RESULTING FROM SAPSUCKER WORK.

The embellishments, sapsucker bird's-eye and curly grain, present to some extent in practically all the wood samples described, while attractive and possibly available for use on a small scale, are usually not marked enough to be of commercial importance. Furthermore, they are invariably accompanied by defects which in most cases rob them of practical value and frequently so disfigure or weaken the wood as to lower seriously or even destroy its market value.

It has been shown that sapsucker work unfits for use such important ornamental woods as mahogany, black walnut, white oak, yellow poplar (*Liriodendron*), chestnut, cherry, sweet gum, and hard maple; that it seriously blemishes woods prized for particular qualities, such as ash, basswood, red cedar, holly, buckeye, dogwood, and hickory, in the case of the latter causing an annual loss of more than half a million dollars; and that sapsucker work sometimes destroys the value of wood even for heavy construction, as in southern basswood, Engelmann spruce, and western hemlock. In all, defects due to sapsucker work have been found in the wood of 174 species of trees.

In 90 of these they are so serious as to spoil the appearance or workability of the wood, and in 22 species they render the wood useless except for coarse construction or for fuel.

Except in the case of hickory, there are not at hand sufficient data to determine the proportion of trees injured by sapsuckers, and hence it is not possible to estimate the actual loss. To remedy this defect in part, the writer has made inventories of the trees of certain areas. Near the mouth of Scotts Run, Fairfax County, Va., an area was marked out and found to contain 55 trees. Ten of these, or 18.1 per cent of the whole number, showed sapsucker work. Of 266 trees on a part of Plummers Island, Md., 36, or 13.5 per cent, have been attacked by sapsuckers. In the west half of the Department of Agriculture grounds at Washington are 232 trees, of which 56, or 24 per cent of the whole, show sapsucker work. The results of less definite observations in the field are as follows: On St. Vincent Island, Fla., only enough live oaks and long-leaf pines are pecked to make 1 per cent of the whole number of trees, but at the Santee Club, South Carolina, 90 per cent of these two species are attacked, as also enough other trees to make the proportion of the whole well over 50 per cent. At Abbeville, La., and Gainesville, Fla., 25 to 60 per cent of the trees in various forests are punctured; at Cottonport, La., about 60 per cent show plentiful pecking, and at Longbridge, La., fully 95 per cent of the trees are profusely drilled, there being only one species, the tupelo gum, on which no pecks were seen. In connection with these estimates it must be borne in mind that we get a record only of the trees which bear considerable sapsucker work, as those with only a few pecks are likely to be unnoted.

In collections of wood specimens in museums, where few if any cases of sapsucker work were overlooked, the following proportions of punctured specimens were noted: One hundred and fifty-one out of a total of about 500, or 30 per cent of those in the American Museum of Natural History, and 71 out of about the same number, or 14 per cent of the specimens in the Arnold Arboretum, Jamaica Plain, Mass., which are mainly smaller pieces of the trees at the American Museum. The difference in size of the samples probably accounts for the discrepancy in the number bearing punctures. The collection of Illinois woods in the Field Museum of Natural History, Chicago, is composed of 197 pieces, of which 36, or 18 per cent, bear sapsucker work. Sixteen out of 64, or 25 per cent, of other United States woods in the same museum were pecked. In the writer's opinion it is safe to assume that at least 10 per cent of the trees in the normal range of the yellow-bellied woodpecker bear marks of its work. This means that the wood of 10 per cent of the trees contains defects.

It has been shown that much white-oak and yellow-poplar veneer and many ash and hickory handles are relegated to the cull grade on account of bird pecks. In hundreds of barrels inspected by the writer in Virginia about 10 per cent of the basswood barrel heads and of the oak staves bore defects sufficient to cause their rejection from the much more valuable furniture or tight cooperage grades. It has been shown, furthermore, that from 16 to 39 per cent of the wood of individual trees, of bald cypress at least, is spoiled by defects due to sapsucker work. However, if only 1 per cent of the lumber of trees attacked (10 per cent of the whole number) is discarded, the annual loss for the whole United States is more than a million and a quarter dollars. It seems certain that this estimate is not excessive, since it takes no account of lumber not rejected but reduced in grade, and since it has practically been demonstrated that the loss on one kind of timber alone, namely hickory, is fully half the sum mentioned. The meaning of these figures will be better understood if one considers that they express the value of five-sevenths the total cut of black walnut in the United States, or very near the value of the total lumber, lath, and shingle production of single States, as Arizona, Colorado, or New Mexico, and considerably more than the value of the lumber produced by any one of nine other States in the Union.[1]

DO OTHER SPECIES OF WOODPECKERS SHARE THE SAPSUCKERS' HABITS?

It has always been a mooted question to what extent, if any, other species of woodpeckers tap trees for the sap. Apparently the red-headed woodpecker is occasionally guilty of the act, but cases where it has been detected actually drilling the holes are so few that the habit must be considered exceptional. Mr. C. A. White writes as follows:

> Upon the Iowa University campus we have a number of grand old aboriginal oaks, a favorite resort for red-headed woodpeckers (*Melanerpes erythrocephalus*). Among the young and growing trees that have been transplanted upon the campus are some sugar maples (*Acer saccharinum*) the bodies of which are 6 to 8 inches in diameter. Seeing the woodpeckers busily tapping upon them, I examined the trunks and found them perfectly sound, but the birds had pierced many holes of the usual size through the bark and into the cambium layer, where they stopped. The sap was flowing freely from the holes, and, watching the movements of the birds afterwards upon the trees, I became convinced that they were sucking the sap and that they had pecked the holes for the purpose of obtaining it.[2]

A western relative of the red-headed woodpecker has been found doing similar work. Mr. F. Stephens makes the following statement in regard to the California woodpecker (*Melanerpes f. bairdi*):

> At one of my camps in the pine region of Smiths Mountain, a family of this species developed the sapsucking habit. I had noticed some fresh holes in the bark of two live oaks, a foot or two from the ground, from which sap was flowing, and later I saw the birds drinking—in one case three were seen drinking at the same time. This is the only instance of the habit in this species that has come under my observation.[3]

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[1] All estimates based on Forest Products Report No. 40, Bureau of Census, 1909.

[2] American Naturalist, VII, 496, 1873.

[3] F. Stephens, in Bendire's Life Histories of N. A. Birds, II, 115, 1895.

Joseph Grinnell records the following observation upon the same species of woodpecker:

> At Seven Oaks, June 24, 1906, we had been watching a Sierra sapsucker (*Sphyrapicus v. daggetti*) industriously running a line of bark pits around the branch of an alder, when a California woodpecker . . . flew down and drove off the sapsucker . . . then went the rounds of the borings himself, "dipping" from each.[1]

This observation suggests that the other records of species of woodpeckers besides sapsuckers tapping trees should refer only to their purloining sap from punctures made by the latter. Be that as it may, the assertion has frequently been made that some of our woodpeckers, notably the downy and the hairy, mark trees in a fashion almost indistinguishable from that of the sapsucker. Some of the European woodpeckers very closely related to our species of the genus Dryobates do a great deal of similar work, even producing large swollen girdles on trees,[2] and it would be surprising if our species were found to be entirely innocent of such practices. Mr. Henry Bryant, of Boston, published the following testimony in 1866:

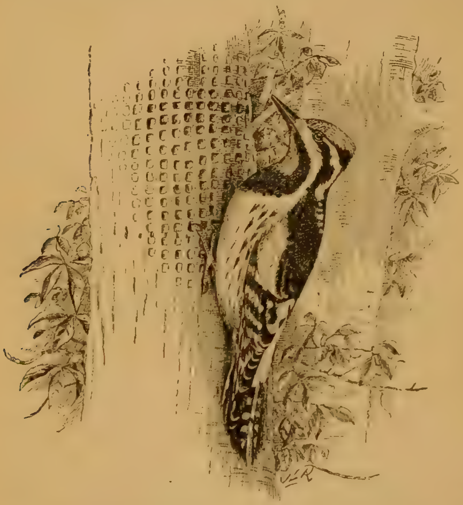

FIG. 38—Yellow-bellied sapsucker. Note the black spot on breast.

> It has long been known that some of our smaller woodpeckers pick out portions of the sound bark of trees, particularly of apple trees, where there are no larvæ and apparently no inducement for them to do so. . . . They [the pecks] are generally seen in circles round the limbs or trunks of small irregularly rounded holes, and in this vicinity are made almost exclusively by the downy woodpecker, *P. pubescens*, aided occasionally by the hairy woodpecker, *P. villosus*.[3]

Dr. J. A. Allen corroborates these statements as follows:

> The perforations made in the bark of trees by woodpeckers, forming transverse rings, and sometimes so numerous as to do serious injury to the trees, have of late been very commonly attributed almost solely to this species [yellow-bellied woodpecker], especially at the West, where it is so numerous. That it is, from this habit, often greatly injurious to fruit trees is not to be denied; but that this species—now commonly styled the "true sapsucker," to whose depredations it is said should be assigned the

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[1] Univ. Calif. Pub. Zool., V, 65–66, 1908.

[2] See Fuchs, Gilbert. Über das Ringeln der Spechte und ihr Verhalten gegen die kleineren Forstschädlinge. Naturwiss. Zeitschr. f. Land u. Forstwirtschaft, III, 317–341, 1905.

[3] Proc. Bost. Soc. Nat. Hist., X, 91–2, 1866.

general ill repute attached to the whole family by most agriculturists—is the sole author of this work, which so often amounts to mischief, there is abundant evidence to disprove. In most parts of Massachusetts, particularly in the Connecticut Valley, this species is so extremely rare that I have never seen more than half a dozen specimens in a year, and oftener none at all, and then always during its migrations; while other expert collectors have searched for it unsuccessfully for years; yet our orchards always present these perforations in profusion, though seldom to an injurious degree; and now and then a forest tree is observed so thoroughly girdled as to be thus destroyed. For this our spotted woodpeckers, *Picus pubescens* and *P. villosus*, are chargeable, being in many sections the sole authors of it; they may be, in fact, very often seen engaged in it. I do not, however, suppose their object to be the same as that assigned to the *Sphyrapicus varius*—that of sucking sap or feeding on the inner bark.[1]

Evidence supporting the same contention is given by Mr. C. K. Reed, who says:

> Most of you have probably noticed apple trees that had rows of holes extending around, or nearly around, the trunk. I was always told, and frequently see it in print now, that these were made by sapsuckers. Perhaps some of them are, but not all. Last fall I watched a downy busily at work hammering on the trunk of an apple tree. He would pound away for about half a minute steadily in one spot and then hitch sideways about an inch and repeat the operation; when he had completely encircled the tree he dropped down about his length and made another ring around the trunk. The marks left on the tree were identical with those that I had supposed were made by the sapsuckers. The downy did not appear to find anything to eat, and I concluded that he was doing it in play or that he wished to sharpen his bill.[2]

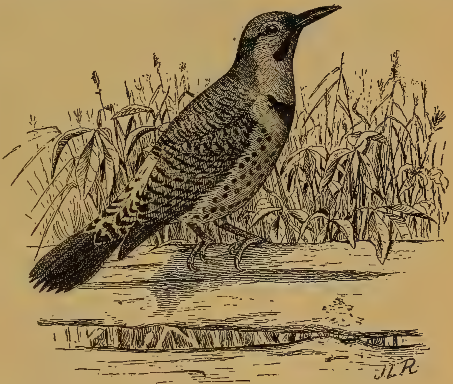

FIG. 39.—Flicker. Not a sapsucker. Has black spot on breast, but top of head from bill is not red. Has conspicuous white rump.

There is one fallacy included or implied in most of the above quotations, namely, that a profusion of punctures in trees where the sapsuckers are scarce proves that the work was done by other woodpeckers. This by no means follows. In most cases the bulk of the pecking on trees is old; only a moderate number of punctures, as a rule, are made each year, and the amount of fresh work rather than the total should be considered in determining the probable agent. A tree 100 years old—a moderate age—might bear much sapsucker work, even where the birds are very scarce and only a few holes were drilled in it each year. When a great number of punctures are made in one season, the tree is likely to be weakened or killed, and not a single instance is on record of any woodpecker in this country, other than a member of the genus *Sphyrapicus*, killing a tree by girdling it. Nor, as a rule, is the work of the hairy and downy woodpecker so much like that of the sapsuckers as not to be distinguishable from it. The writer has observed the downy woodpecker at work in suspicious proximity to fresh drills resembling those made by sapsuckers. But upon examination these were found to go barely through the outer bark and not to the sapwood, as is true of sapsucker holes. Hence the punctures were not injurious. Mr. E. H. Forbush notes [1] that the perforations made by the downy [in red maple] differ from those of the sapsucker; and Weed and Dearborn seem to have had similar experience, as they say of the downy woodpecker: "Although it bores holes in the bark of apple trees, it does not revisit them to suck the sap . . . and the holes seem usually not to injure the tree."[2] Prof. F. E. L. Beal corroborates this, saying that the holes made by this woodpecker reach only to the inner bark and that no protruding girdles or other deformations of the trunk are produced.

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[1] Mem. Bost. Soc. Nat. Hist., I, 499, 1869.

[2] Bien. Rep. Commissioner Fish. and Game, Ind., p. 733, 1905–6.

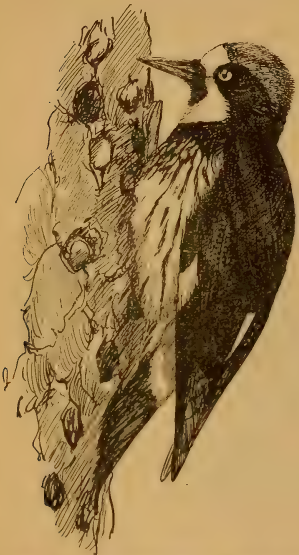

FIG. 40.—California woodpecker. Not a sapsucker. Has black breast spot, but head is not red from base of bill.

A very convincing bit of evidence bearing on this point is given by Dr. T. M. Brewer. He had experience in parts of the country where the sapsucker is not often seen, but where there are many punctured trees, conditions which cause the downy, hairy, and other woodpeckers to be known as sapsuckers and to be persecuted. Upon becoming well acquainted with *Sphyrapicus* also, he wrote as follows:

> In April, 1868, I visited gardens in Racine, in company with Dr. Hoy, where these woodpeckers [i. e., sapsuckers] had every successive spring committed their ravages, and was eyewitness to their performance. Their punctures were unlike those of *pubescens* (downy), being much deeper, penetrating the inner bark, and being repeated in close proximity, . . . often resulting in the girdling and complete destruction of a tree. In one garden of some considerable size all the mountain ash and white pine

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[1] Useful Birds and their Protection, p. 256–7 [1907].

[2] Weed, C. M., and Dearborn, N., Birds in their Relations to Man, p. 185, 1903.

trees had thus been killed. In prairie countries, where trees are a deficiency and their cultivation both important and attended with difficulty, these birds prove a great pest, and in a few hours may destroy the labor of many years.[1]

Whether or not the downy and other woodpeckers seek sap, it is beyond question that they are not important consumers of cambium, since on the average much less than 1 per cent of this substance has been found in the stomach contents of any other woodpecker than the true sapsuckers (*Sphyrapicus*).[2] It is the loss of cambium rather than of sap that breaks down the vigor of the trees and is responsible for defects in the wood, and to the sapsuckers, which consume cambium to an average extent of 13.8 per cent of their annual food, must be attributed most if not all serious injuries to trees due to the destruction of cambium by woodpeckers.

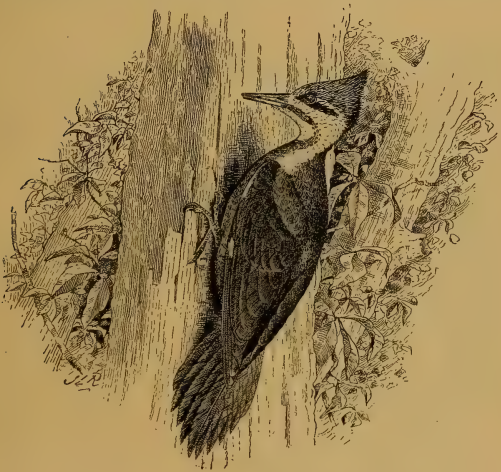

FIG. 41.—Pileated woodpecker. Not a sapsucker. Entire lower parts black.

FOOD OF SAPSUCKERS.

About four-fifths of the insect food of the three species of sapsuckers consists of ants, the eating of which may be reckoned slightly in the birds' favor. The remainder of the food is made up of beetles, wasps, and a great variety of other insects, including, however, practically no wood-boring larvæ or other special enemies of trees. The birds' vegetable food can not be cited in their behalf, as it consists almost entirely of wild fruits, which are of no importance, and of cambium, the securing of which results in serious damage, as shown in the preceding pages.

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[1] Baird, Brewer, and Ridgway, History of N. A. Birds, Land Birds, II, 542, 1874.

[2] A mere glance at the figures (3 and 4) of the tongues of the yellow-bellied sapsucker and the downy woodpecker must convince anyone that these birds are adapted to the utilization of entirely different food supplies.

HOW TO RECOGNIZE SAPSUCKERS.

Plate I (frontispiece) and Plate II (p. 16) will serve to identify the sapsuckers better than pages of printed descriptions, and therefore only a few marked color differences will be mentioned here. All sapsuckers have yellow bellies, few other woodpeckers have; all sapsuckers have a conspicuous white patch on the upper part of the wing, as seen from the side when clinging to a tree; white wing patches in other woodpeckers are on the middle or lower part of the wings. The yellow-bellied sapsucker of transcontinental range is the only woodpecker having the front of the head (i. e., from bill to crown) red in combination with a black patch on the breast. The red-breasted sapsucker lives west of the Rockies and is the only species there having the whole head and throat red.

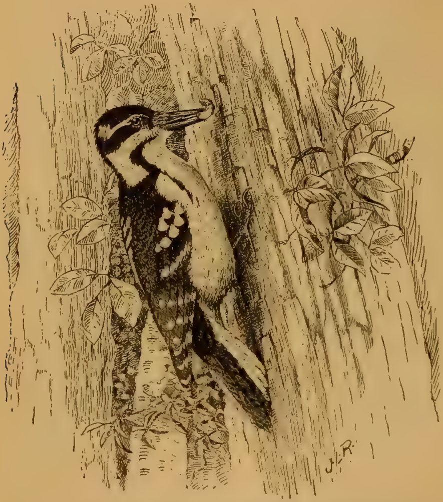
FIG. 42.—Hairy woodpecker. Not a sapsucker. No black breast spot.

From 4 to 11 species of woodpeckers other than sapsuckers occur in various sections of the United States; hence a majority of woodpeckers seen are not sapsuckers. Several of these species are illustrated (figs. 38 to 44), and notes are given on the features distinguishing them from sapsuckers.

DEFENSIVE MEASURES AGAINST SAPSUCKERS.

Mr. C. G. Bates says of the eastern bird:

> The sapsucker spends only his winters in the hardwood region, and the greatest damage is done on warm winter days and in the spring just before migration. For this reason hickories should not be planted, especially in the South, in situations where they will be started by the first warm days, but rather where their rise of sap will be retarded.

This advice applies to the planting of orchards also, as the risk of damage by frost is lessened by planting on north slopes. It is said that fine wire netting has been used in some localities to protect the trunks of fruit trees, but this is impracticable for large numbers of trees, while advice as to methods of planting does not apply to trees at present subject to sapsucker attack. Good results have been obtained by plastering cow droppings or fish glue around trees where the sapsuckers have worked, and the wounds may be made to heal more readily by cutting out the injured parts and covering with grafting wax.

When preventive measures fail and the extent of the damage warrants it, the birds must be killed. But such extreme measures should be adopted only when orchards or other valuable tree plantations are attacked, and extreme care should be taken to kill only the injurious species.

It does not appear to be difficult to poison sapsuckers. Mr. Ellwood Cooper has kindly furnished details of a method of poisoning used successfully by himself in California, of which the following is the substance: I took about one-half pint of honey and pulverized the crystals of strychnine, using about a coffeespoonful of the powder and making a thorough mixture. With a wooden paddle I smeared the mixture around the trunk about 2 or 3 inches above the last ring of holes made by the birds. It proved very effective. This method has the advantage of insuring the destruction of the sapsuckers, while the risk of destroying other birds is reduced to a minimum.

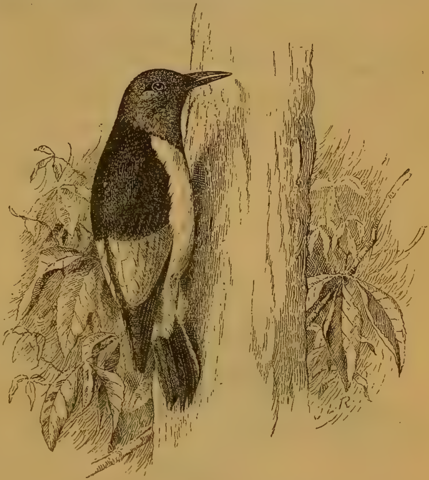

FIG. 43.—Red-headed woodpecker. Not a sapsucker. Has no black spot on breast.

The method of poisoning may be stated in more exact terms as follows: Mix thoroughly an eighth of an ounce of powdered strychnine (the alkaloid, which is not easily soluble, and hence will not flavor the mixture) with 1 pint of honey or other thick sirup. Apply to the injured tree just above the rows of fresh punctures.

A simpler way of poisoning the sapsuckers was discovered by Mr. Ned Dearborn of the Biological Survey. The powdered strychnine (alkaloid) was introduced directly into the fresh sap pits, by means of a bit of straw or grass stem. A very small quantity sufficed for each hole, and the poison remained effective for at least two days. It should be noted here that humming birds and some other small birds, particularly warblers, will be killed by poison intended for sapsuckers. Nevertheless, taking all things into consideration, it seems wise to recommend the use of poison rather than the gun.

GENERAL CONCLUSIONS.

From an economic standpoint woodpeckers may be divided into two groups:

(1) The woodpeckers proper, which are chiefly beneficial. These slightly damage trees when excavating nests and shelter cavities. In some sections they are responsible also for injury to telephone and telegraph poles and for minor damage to houses, barns, fences, and other structures. To minimize this damage the trial of nesting boxes especially designed for woodpeckers is recommended. Killing the birds should be the last resort. When all is said and done, however, woodpeckers of this group much more than compensate for all the harm they do by devouring large numbers of the insect enemies of trees, many of which are preyed on by no other birds.

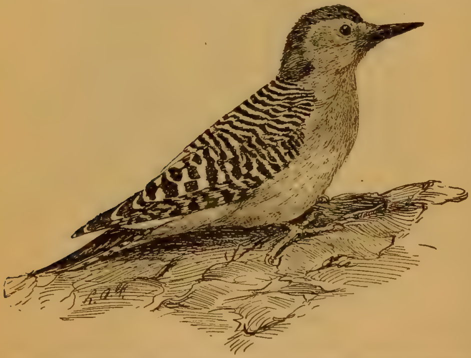

FIG. 44.—Red-bellied woodpecker. Not a sapsucker. No black breast spot.

(2) Sapsuckers, which are very injurious. The sapsuckers, unlike other woodpeckers, secure a considerable part of their subsistence from the tissues and juices of trees. In doing this they often destroy so much of the cambium or growing layer that the trees are weakened and disfigured or even killed. Further, the wood of many of the trees they attack is so stained and distorted during the healing process that its value for lumber is impaired or destroyed. The loss

from this cause in the United States is more than one and a quarter million dollars annually. Sapsuckers do not prey upon any especially destructive insects and do comparatively little to offset the damage they inflict. Hence the yellow-bellied sapsucker (*Sphyrapicus varius*) and its western variety (*Sphyrapicus v. nuchalis*), the red-breasted sapsucker (*Sphyrapicus ruber*) and its northern form (*Sphyrapicus r. notkensis*) must be included in the class of injurious species, the destruction of which when caught red-handed is justifiable. In certain States it may prove desirable to deny these birds the degree of protection they now enjoy. We know too little at present to decide the status of the Williamson sapsucker (*Sphyrapicus thyroideus*).

As there are 20 species of woodpeckers in the United States and only 2 of them are under indictment, great care should be exercised to distinguish the real offenders. When it is necessary to destroy sapsuckers, poison should be used because of the small risk to other species of birds.

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Issued December 21, 1911.

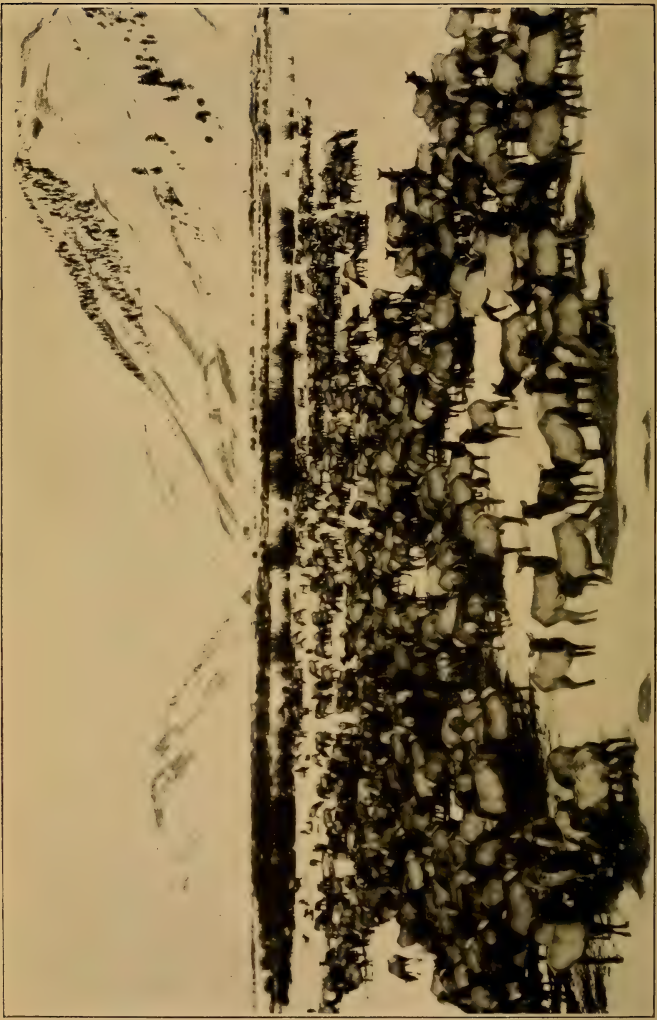
U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 40
HENRY W. HENSHAW, *Chief*

REPORT ON CONDITION OF ELK IN JACKSON HOLE, WYOMING, IN 1911

BY

EDWARD A. PREBLE
Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911



A HERD OF ELK AT FEEDING TIME, JACKSON HOLE, WYOMING, WINTER OF 1910-11.

(Photographed by S. N. Leek.)

Issued December 21, 1911.

U. S. DEPARTMENT OF AGRICULTURE

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., November 1, 1911.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 40, a Report on the Condition of Elk in Jackson Hole, Wyoming, in 1911, by Edward A. Preble, assistant in the Biological Survey. At the last session of the sixty-first Congress an item was incorporated in the appropriation for the Biological Survey "for the feeding, protecting, and removal of elk in the country known as Jackson's Hole and vicinity, in the State of Wyoming." Steps were immediately taken to obtain the information necessary to enable the Biological Survey to undertake intelligently and effectively the solution of the elk problem in Wyoming. Mr. Preble was directed to proceed to Jackson Hole, and Mr. D. C. Nowlin, formerly game warden of the State, was appointed as his assistant. They were instructed: (1) To make a thorough examination of existing conditions, to ascertain approximately the number of elk which perished by starvation, and to collect all available data respecting the life history and local distribution of the animals; (2) to cooperate with the State in feeding the elk and to arrange for obtaining a supply of feed for the winter of 1911–12; (3) to investigate the feasibility of transferring a few animals to other parts of the State or to game preserves in other States where nucleus herds might be established under Federal or State auspices. Upon arrival in Jackson Hole Messrs. Preble and Nowlin found that the State had already purchased and was feeding all the hay available and nothing further in this direction could be done except to make arrangements for the following winter. On account of the lateness of the season and the impassability of the roads it was practicable to make only one experimental shipment of elk, and 12 animals were successfully transported across Teton Pass. Seven of these were shipped to the National Bison Range, in Montana, and 5 to the Wichita National Game Refuge, in Oklahoma. All of them arrived in good condition and are doing well.

The Biological Survey has undertaken not merely temporary relief during one or two severe winters, but an investigation, in cooperation with the State of Wyoming, of the broader problem of the maintenance of the elk herd of Jackson Hole as one of the important resources of the State and as a permanent source of income. Such an investigation includes collection of all available data on the natural history of the elk; a review of the efforts which have been made by the State to protect and perpetuate the species; the losses by wolves, poaching, and starvation; experiments in feeding during severe weather; provision for summer range in the State game preserve; and recommendations for winter refuges where an adequate supply of forage may be obtained. The present publication is a preliminary report and deals mainly with the information collected regarding the condition of the elk during the past winter. It will probably be followed shortly by a summary of the work accomplished by the State, and later by reports on feeding and refuges and other problems concerning which data are not yet ready for publication.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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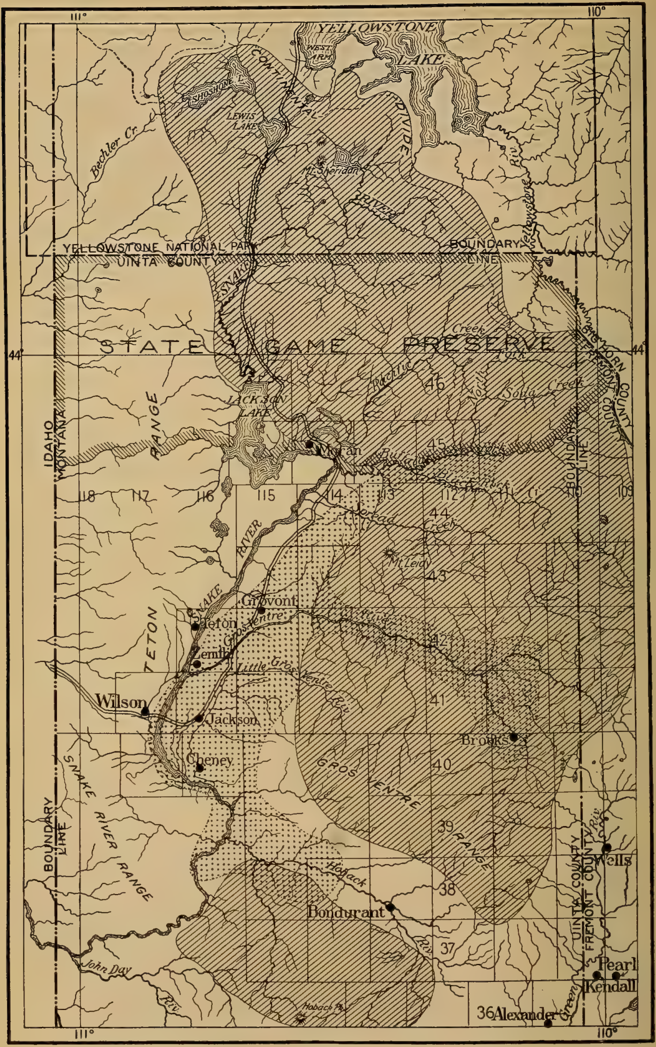
111°
110°
YELLOWSTONE LAKE
WEST ARM
SHOSHONE L.
LEWIS LAKE
CONTINENTAL DIVIDE
Mt. Sheridan
RIVER
Bechler Cr.
Yellowstone Riv.
YELLOWSTONE NATIONAL PARK BOUNDARY LINE
UINTA COUNTY
SNAKE
STATE GAME PRESERVE
44°
JACKSON LAKE
Moran
Pacific
Creek
North Fork
Soda Creek
Buffalo
Black Rock
BIG HORN COUNTY
FREMONT COUNTY
BOUNDARY LINE
IDAHO
MONTANA
TETON RANGE
118
117
116
115
114
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109
46
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42
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38
37
36
SNAKE RIVER
Spread Creek
Mt. Leidy
Grovont
Teton
Gros Ventre
Zenith
Little Gros Ventre Riv.
Wilson
Jackson
Brooks
Cheney
GROS VENTRE RANGE
SNAKE RIVER RANGE
BOUNDARY LINE
Hoback
Bondurant
Riv.
John Day Riv.
Hoback Pk.
Wells
UINTA COUNTY
FREMONT COUNTY
Green Riv.
Pearl
Kendall
Alexander

Part of Northwestern Wyoming, Showing Approximate Range of Elk which Winter in Jackson Hole.

▨ Summer range. ░ Winter range.

REPORT ON CONDITION OF ELK IN JACKSON HOLE, WYOMING, IN 1911.

INTRODUCTION.

That part of the valley of Snake River in northwestern Wyoming usually called Jackson Hole has long been the principal winter home of large numbers of elk, or wapiti (*Cervus canadensis*). These animals, which spend the summer in the southern part of Yellowstone National Park and in the mountains south of it, are forced in winter to seek lower levels, where a lighter snowfall and a milder climate insure more favorable forage conditions. Their primitive winter range has gradually been reduced, until this basin has become their principal stronghold. Here, until recent years, the herds have fared well, except in an occasional abnormal winter; but with increased settlement in this valley has come depletion of the range by grazing. The elk have come down in their old or even in augmented numbers only to find their former haunts shorn of forage by cattle, and when unusual winter conditions have conspired with a lessened food supply, great suffering and loss of life have ensued. Such was the case during the winters of 1908–9 and 1909–10, and during that of 1910–11, when an almost unprecedented fall of snow following a dry summer covered to a depth of several feet the remnant of a scanty crop of grass, conditions became acute. The elk sought the valley in about their normal numbers, but a little earlier than usual, and before the winter was half over had suffered great loss. The State legislature was appealed to and promptly appropriated money to buy food for the starving creatures. Moreover, the State, realizing its inability to cope with the situation unaided, presented the following memorial to Congress:

House Joint Memorial No. 1.

A joint resolution relating to the preservation of big game in the State of Wyoming, and memorializing the Congress of the United States to make an adequate appropriation to aid the State of Wyoming in providing winter food for and otherwise protecting the big game which range in the National Park and in the Jackson Hole region of this State, alternately.

Be it resolved by the house of representatives (*the senate concurring*):

Whereas the principal remnant of the big game of the United States, comprised of moose, elk, and deer, range alternately during the winters in the National Park and game reserve and the Jackson Hole section of the State of Wyoming, south of the National Park; and

Whereas during the winters they suffer greatly and perish from famine in large numbers, which could be in a great measure prevented by adequate and systematic provision for feeding and protecting them during storms and blizzards; and

Whereas the State of Wyoming has been and is making appropriations of large sums of money and using every available means within its power to preserve said big game; and

Whereas the sufficient and thoroughly adequate protection of said big game is too expensive and burdensome to be borne alone by the State of Wyoming: Therefore be it

Resolved by the Legislature of the State of Wyoming, That the Government of the United States be, and is hereby, requested to cooperate with the State of Wyoming in feeding, protecting, and otherwise preserving the big game which winters in great numbers within the confines of the State of Wyoming; and the Congress of the United States is hereby memorialized and requested to make an adequate appropriation of money, to be used in aiding and cooperating with the State of Wyoming in the laudable and desirable effort to feed, protect, and preserve from extinction the principal remnant of the big game of the United States, which range during the winters principally within the territory of the State of Wyoming; be it further

Resolved, That engrossed copies of this memorial and request be sent to the President of the United States, to the President of the United States Senate, to the Speaker of the United States House of Representatives, and to the Secretary of the Interior, asking their aid in bringing the object of this memorial and request before Congress and in securing from same an adequate appropriation of public moneys for the noble, humane, and national purpose herein set forth; and be it further

Resolved, That engrossed copies of this memorial and request be sent to the Senators from Wyoming in the Congress of the United States, viz., Hons. CLARENCE D. CLARK and FRANCIS E. WARREN, and our Representative in said Congress, Hon. FRANK W. MONDELL, asking them to use their best efforts to secure favorable action upon the request embodied herein.

Approved February 17, 1911.

In accordance with this memorial the act approved March 4, 1911, making appropriations for the Department of Agriculture, included an item of $20,000 immediately available for feeding, protecting, and removing elk in Jackson Hole and vicinity. The administration of this fund was intrusted to the Biological Survey, and to the writer was assigned the task of making the preliminary investigation.

ITINERARY.

I left Washington on March 7, 1911, and reached Cheyenne, Wyo., March 9. Here I was joined by Mr. D. C. Nowlin, formerly State game warden, who was to be associated with me in the work. Pursuant to my instructions, conferences with Gov. Joseph M. Carey were held on March 10 and 11. The governor, as chairman of the newly established game commission, expressed himself as pleased to see steps taken toward Federal cooperation in the protection of the elk, and furnished me letters of introduction and a permit to capture a number of animals for removal to parks in other States. On March 12 Mr. D. F. Hudson, the present State game warden, joined us, and the next day Mr. Hudson, Mr. Nowlin, and I left Cheyenne for Jackson Hole, via Pocatello and St. Anthony, Idaho. To reach the scene of our work, a two days' stage trip after leaving the railroad was necessary. We left St. Anthony on March 15 and passed the night at Victor, Idaho, close to the western base of the lofty and picturesque Teton Range. Next day we crossed this range, over from 10 to 40 feet of snow, via the Teton Pass, at 8,429 feet altitude, and descending the eastern slope of the range crossed Snake River and reached the town of Jackson. This point, in the southern part of Jackson Hole, was our headquarters for nearly three months. From here we made trips by stage and other conveyances and on foot to various parts of the valley of Snake River from the head of Jackson Lake south nearly to Hoback River and visited also the valleys of Buffalo and Gros Ventre Rivers. We left the valley in early June to take up other work, but Mr. Nowlin returned about August 1 and continued the investigations.

During the progress of the work I was greatly assisted by Mr. Nowlin. His intimate personal acquaintance with the people of the region and with the various phases of the problem made him peculiarly valuable. To the residents of the region, also, I am greatly indebted for courtesies extended.

GENERAL DESCRIPTION OF THE REGION.

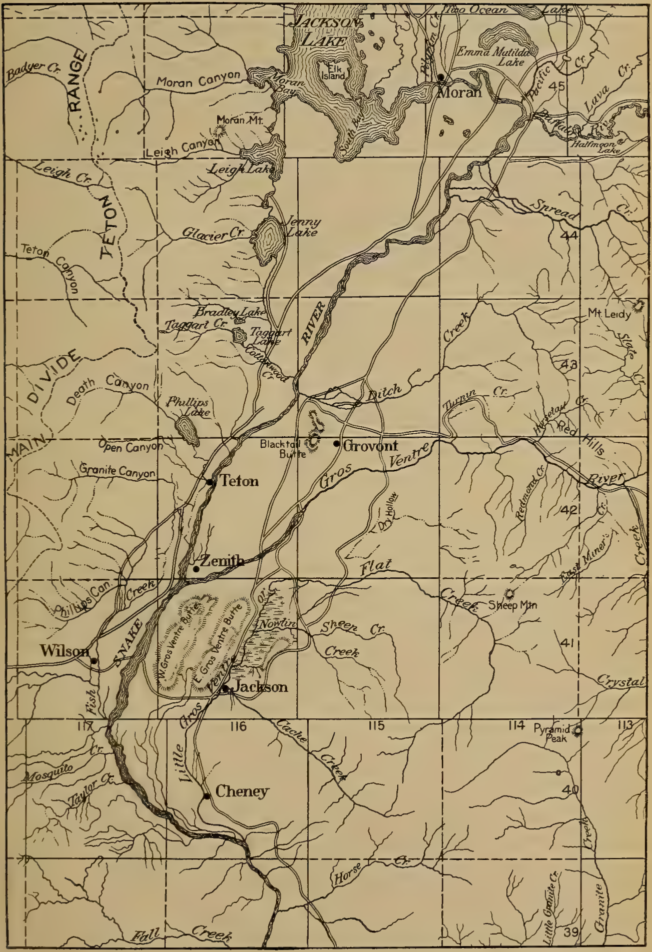
Jackson Hole is the name commonly applied to that part of the Snake River Valley between Jackson Lake and the mouth of Hoback or Fall River. (See map, Pl. III.) It is a basin about 40 miles in length from north to south and averaging about 15 miles in width and extends in a north-northeast and south-southwest direction. It has an altitude of about 6,700 feet at its north end and falls to about 6,000 feet at its southern extremity. Snake River, after issuing from Jackson Lake, traverses the valley in a direction slightly nearer southwesterly than the general trend of the basin, entering it at its northeastern extremity and crossing to its western border in the course of a few miles. This river has a rather uniformly rapid current and is moderately direct in its course, but in places divides into numerous channels inclosing large islands. From the east it receives successively Pacific Creek (whose twin, Atlantic Creek, heading in the same meadow, is tributary to the Missouri), Buffalo River or Buffalo Fork, Gros Ventre River, and Little Gros Ventre or Flat Creek. Parts of Snake River and its larger tributaries are bordered by groves of narrow-leaf cottonwoods (*Populus angustifolia*), interspersed with a few spruces, with an undergrowth of dogwood, alder, and other shrubs. Along some of the tributaries of Snake River are natural marshy meadows which support a rank growth of marsh grasses, with thickets of willows on their borders and along the streams, and a variety of marsh-loving shrubs and other plants on their drier parts. One of the more extensive of these meadows lies along little Gros Ventre Creek above the town of Jackson, and will be referred to in more detail later.

By far the greater part of the area embraced in the basin called Jackson Hole is covered by a fairly rank growth of sagebrush (*Artemisia tridentata* and *A. cana*). Large areas of this land have been cleared and under irrigation produce fine crops of alfalfa and timothy and fair yields of oats, barley, and wheat. The altitude of the valley and the proximity of large areas of high mountains cause frost to be common through May and in exceptional seasons in August. The shortness of the growing season prevents the successful raising of any but forage crops besides the hardier grains and roots, except in a few favored localities.

The winters are long and severe and the snowfall heavy, though the amount in any particular section varies greatly from year to year. Thus, while the depth of snow is usually greater in the upper Gros Ventre Valley than about Jackson, the contrary was the case during the winter of 1910–11. The amount of snow which fell in the Valley of Spread Creek was also much less than on Antelope Flat, only a few miles distant, or about Jackson, though all three places are near the same altitude. These local fluctuations seem to be due to the proximity of the lofty Teton Range, which influences to a remarkable degree the direction and intensity of local storms. In early January, 1911, about 4 feet of snow fell within 48 hours in some parts of the valley. On the mountains the amount of snow is, of course, much greater and the winter of longer duration than in the valley. On the Teton Pass (8,429 feet), practically the only means of access to the valley, snowstorms are frequent until midsummer, and even in the lower part of the valley it is not unusual for snow to fall in late May and in September.

In the spring of 1911 the winter's snow was practically gone in the main part of the valley on April 20, but the mountains and foothills above 7,000 feet were as white as in midwinter.

Bordering the valley on the west is the Teton Range, a succession of rocky crags with altitudes varying from about 10,000 to nearly 14,000 feet. (See Pl. IV, fig. 1.) These rise abruptly from the comparatively low and level valley (6,000 to 6,700 feet), affording a panorama whose equal in rugged grandeur is rarely seen. To the east the valley is bordered by foothills of the Gros Ventre Range, some of whose peaks reach an altitude of about 11,000 feet. These mountains are treeless above 10,000 feet. Below this the mountain slopes are usually well wooded, the commoner trees being Engelmann spruce (*Picea engelmanni*), Douglas spruce (*Pseudotsuga taxifolia*), and aspen poplar (*Populus tremuloides*). Within the confines of the valley arise several so-called buttes, which rise about 1,000 feet above the general


Jackson Lake
Elk Island
Two Ocean Lake
Emma Matilda Lake
Pilgrim Cr.
Moran
Pacific Cr.
Cr.
45
Lava Cr.
Buffalo Riv.
Halfmoon Lake
Badger Cr.
Teton Range
Moran Canyon
Moran Bay
Moran Mt.
South Bay
Leigh Canyon
Leigh Cr.
Leigh Lake
Jenny Lake
Glacier Cr.
Teton Canyon
Spread Cr.
44
Bradley Lake
Taggart Cr.
Taggart Lake
Cottonwood Cr.
River
Creek
Mt Leidy
Slate Cr.
43
Main Divide
Death Canyon
Phillips Lake
Ditch
Turpin Cr.
Ilesetau Cr.
Red Hills
Blacktail Butte
Grovont
Open Canyon
Granite Canyon
Teton
Gros Ventre River
Redmond Cr.
42
Cr.
East Miner's Cr.
Creek
Dry Hollow
Zenith
Flat Creek
Sheep Mtn
Phillips Can.
Creek
Snake
W. Gros Ventre Butte
E. Gros Ventre Butte
Nowlin
Sheep Cr.
Creek
41
Wilson
Fish
Jackson
Gros Ventre
Crystal
117
116
115
114
113
Cache Creek
Pyramid Peak
Mosquito Cr.
Taylor Cr.
Little Gros
Cheney
40
Creek
Horse Cr.
Little Granite Cr.
Granite Creek
39
Fall Creek

JACKSON HOLE AND VICINITY, WYOMING.

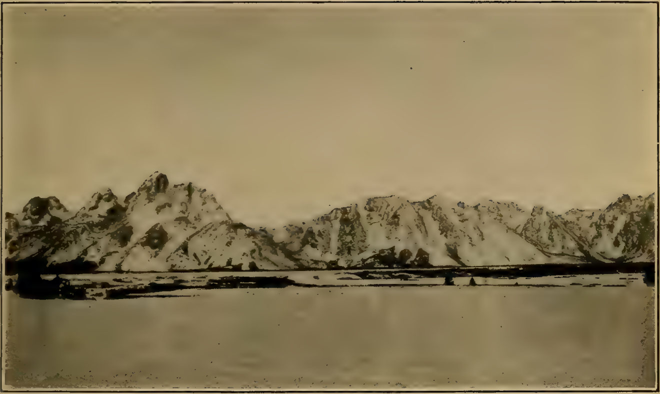


FIG. 1.—TETON RANGE, BORDERING JACKSON HOLE ON WEST. VIEW FROM NEAR GROVONT, MARCH 24, 1911.

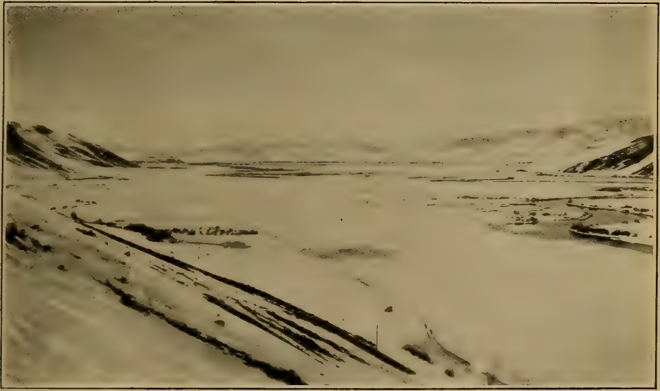


FIG. 2.—MARSH BORDERING LITTLE GROS VENTRE OR FLAT CREEK, ABOVE JACKSON. VIEW NORTHEASTWARD FROM BASE OF EAST GROS VENTRE BUTTE, NEAR JACKSON, MARCH 21, 1911.

level. These are mostly devoid of trees, but support a few groves of aspen poplar and an occasional juniper (*Juniperus scopulorum*), nut pine (*Pinus flexilis*), or Douglas spruce. These hills, especially during moist seasons, produce a growth of grasses and other herbaceous plants which are excellent for forage and, as their steep slopes are early bared of snow by the action of sun and wind, they furnish fine feeding grounds for both stock and game.

In this fertile valley, with its luxuriant growth of forage and comparatively mild climate, most of the elk which summer in the adjacent mountains and in the great area of high country extending northward into the Yellowstone National Park have lately spent the winters.

In former years large numbers, probably the great majority of those which summered in the high ranges of northwestern Wyoming, wintered on the Red Desert and other parts of the comparatively low country lying to the southward. Occupation of these tracts by sheep, with its attendant persecution and gradual depletion of the range, has forced the elk to confine their southward movements within ever-narrowing limits. Within the past few years the further march of settlement into the higher valleys, with the attendant utilization of the range for cattle grazing, has caused a serious diminution in the natural food supply available each winter for the elk.

Thus, although elk probably became more numerous in Jackson Hole after settlement began, it is painfully evident that during the past few years the encroachments of civilization and coincident unfavorable winter conditions have resulted in serious inroads on their numbers.

VALUE OF ELK TO THE REGION.

Some of the most intelligent residents of Jackson Hole have estimated that the value of the elk to the region is equal to the revenue derived from stock raising, which is the principal industry. Others, while considering this estimate excessive, admit that the value of the animals is very great, and that without them the region under present conditions would not support nearly so large a population as it now does. Whatever the opinion of individuals on this point, it is evident that elk have played a very important part in the development of the region. Probably a majority of the more successful residents owe their start to the presence of these animals. Many trappers and hunters who were first attracted to this part of the State by the abundance of game, and later by the opportunities which it offered for acting as guides to visiting sportsmen, have now extensive stock interests and have abandoned their former pursuits, while others still guide hunting parties.

The amount of money which the elk are instrumental in bringing into the country is very large. During the hunting season of 1910, 24 nonresident hunting licenses were granted in the four precincts of Jackson Hole, and in addition many parties who obtained licenses at other points—notably Cody, Lander, Dubois, Rock Springs, and Pinedale—hunted in the Jackson Hole region. Hunters are obliged to hire guides, packers, cooks, and pack animals, and to provision the party. A conservative estimate places the average daily expense of a person hunting in this region at $14. Thus, a trip of 30 days would cost each nonresident $420. Practically all this is spent in the vicinity of the hunting grounds.

The food value of the animals killed by residents is also very large. During the season of 1910, 413 resident licenses, each good for the capture of two elk, were granted in Jackson Hole. It is fair to assume that 800 elk, with an average value of $20, not counting the value of hides, horns, and scalps, were taken under these licenses.

NUMBER OF ELK IN JACKSON HOLE REGION.

Any statement regarding the number of elk in the Jackson Hole region can be only approximate. This is evident since, out of the large number of estimates obtained from residents, the smallest and largest given by persons whose opportunities for intelligent judgment were about equal varied as one to four. The migratory habits of the animals and the difficulty of traveling during the season when they are most easily observed makes it difficult to judge their numbers. Careful consideration of all the data obtained leads me to estimate at from 20,000 to 25,000 the number which habitually range in the region drained by Snake River south and west of the Continental Divide in the southern part of the Yellowstone National Park, most of which spend the winter in the Jackson Hole region as above defined. Recent investigations have established the fact that a line approximately represented by the Continental Divide in the southern part of Yellowstone National Park separates the northward and southward migrating bands of elk. A conservative estimate of the number of Jackson Hole elk which summer north of Buffalo Fork, the southern boundary of the game preserve, is 12,000, and of this number not more than 4,000 (or 20 per cent of the total number wintering in Jackson Hole) cross the boundary of Yellowstone Park to spend the summer. Owing, moreover, to the fact that snow remains deep on these high mountains until very late, it is midsummer before this part of the park is suitable for occupancy. By mid-September snow has again begun to fall, and the elk start to move southward from the Divide and soon regain the game preserve, where the rest of the 12,000 have spent the summer.

The remaining 8,000 which complete the total of 20,000, a conservative estimate of the number inhabiting the Jackson Hole region, spend the summer principally between Buffalo Fork and Gros Ventre

River, and in the Gros Ventre Range to the southward between the Snake and Green River Valleys. A few hundred animals from the more easterly of these bands probably winter in the Green River Valley, but most of them seek Jackson Hole at that season.

Most of the residents consider that the elk have increased in numbers within the last 10 years, but nearly all agree that there has been a decided decrease within the last 3 years. This is owing, of course, to the large number which died during these winters because of abnormal conditions.

Assuming that the elk number 20,000 and that the number of each sex is approximately the same, the herd just before calving time following a normal winter will be divided approximately as follows:

5,425 cows 4 years old and over.
1,200 cows 3 years old.
1,500 cows 2 years old.
1,875 female calves.

10,000 females in all.
10,000 males in all, of approximately the same relative ages.

20,000

It is elsewhere estimated that from 2,000 to 2,500 elk starved to death in the Jackson Hole region in the winter of 1910–11, and it must be borne in mind that this disastrous season was preceded by two others notable for heavy loss. It is plain that the animals can not maintain their numbers under such drains. But so high is the birth rate that elk will hold their own under a considerable winter loss.

The estimate already given is that a band of 20,000 elk will include about 6,625 cows 3 years old and over, of which about 75 per cent, or 4,968, will drop calves each year. If, then, the elk are not to fall below their present numbers, the total deaths from all causes must not exceed 4,968 per year; or, in other words, the total deaths each year may rise to 4,968 and still the elk will hold their own.

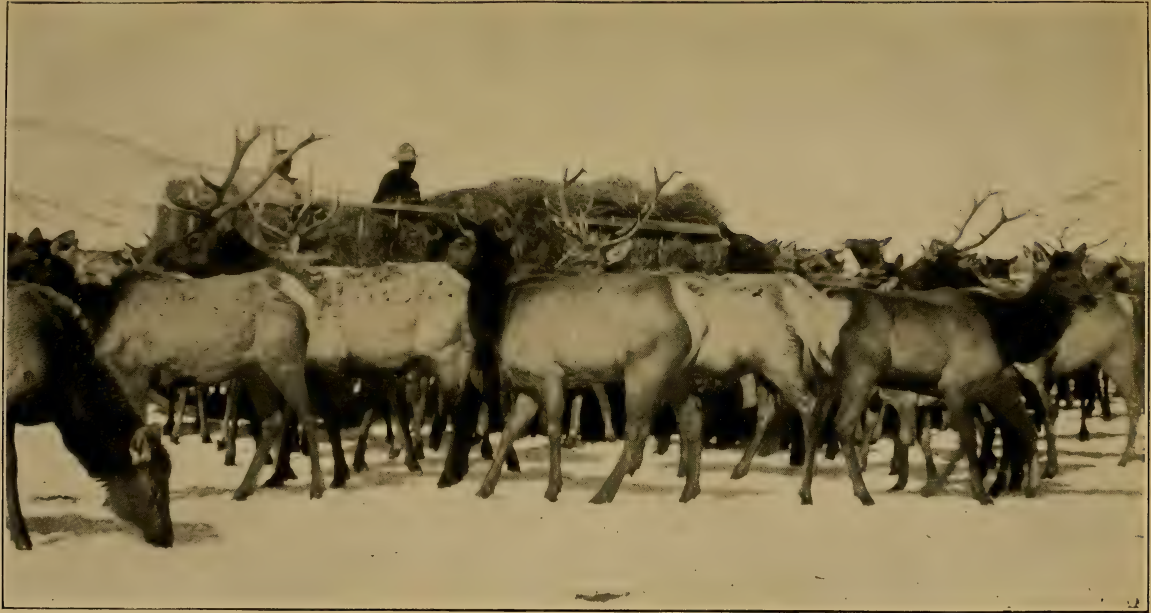
The total death roll is the result of four causes: (1) Natural causes, including accidents; (2) starvation; (3) wolves and other predatory animals; (4) hunting. It is evident that anything done to decrease losses from the first three causes will increase the number of elk that can be shot each year without diminishing the herd as a whole. But just in proportion as starvation or wolves claim a greater number of victims must the number shot be curtailed, or else the total of the elk will be diminished.

At present, probably about 2,000 elk a year are killed by hunters and about 1,000 by wolves. If these figures are approximately correct, and if it is also true, as claimed, that under normal winter conditions the elk hold their own notwithstanding these heavy losses, then it follows that of the calves dropped each year (approximately

5,000), at least 48 per cent live to be 3 years old. If the herd just holds its own, the death loss each year would be about 1,200, or one-fourth of the calves; 800, or one-fifth of the yearlings; 600, or one-fifth of the 2-year-olds; and 2,400 mature animals. Comparison of these figures with those of the losses by starvation of the calves during the past three seasons shows how rapidly the total number of elk must have diminished.

FEEDING IN WINTER.

The two winters preceding the past one (1910–11) had been unusually disastrous to the elk, and some feeding had been done. When it became evident, following the crusting of the deep snowfall of early January, that the loss was likely to be unprecedented, the legislature was appealed to and promptly made an emergency appropriation. As a result, about the 15th of February the feeding of hay was begun on as large a scale as possible. The construction of a large dam by the Reclamation Service at the outlet of Jackson Lake had created an abnormal demand for hay, and an amount approximately equal to the normal excess supply had already been taken out of the valley. It was, therefore, possible for the State to procure only about 250 tons, and, while this saved large numbers of the animals, it was far less than the amount needed. Arrangements were usually made to have the hay fed by the person of whom it was purchased, a certain amount, varying with the number of animals which could be most readily reached, being hauled each day to some point easily accessible to them. The elk soon learn the time of feeding and come readily to meet the loads. (See Plate V.) It is the custom of most of the feeders to drive past a band, and, as the more eager of the animals follow the load, the herd is gradually "strung out," in popular phrase; that is, becomes scattered in a long line. The course is then retraced or paralleled and the hay is thrown out in small quantities at short intervals. This method insures a fair share of hay to most of the animals, large and small. The latter part of the afternoon is considered the best time for feeding the elk, since they are then fortified for the night. One of the results of feeding is that the animals become extremely tame, especially when approached only in vehicles or on horseback. This familiarity, however, is quickly lost when the feeding is discontinued, and within a few weeks those which ate freely from the hand of their benefactors become as wild as ever. It is supposed by some that the feeding during past years has caused the animals to seek the region earlier, and it is a fact that their advent in the autumn of 1910 was sooner than usual, but probably this resulted from the weather conditions rather than from the fact that they had been fed during the previous winter.



FEEDING ELK IN SOUTH PARK, NEAR JACKSON, LATE WINTER, 1910-11.

The elk soon learn the time of feeding and come readily to the loads. (Photographed by S. N. Leek.)

LIFE HISTORY OF ELK.

DISTRIBUTION IN SUMMER.

The elk which winter in the Jackson Hole region come from the Gros Ventre and other ranges to the eastward, and from the mountains lying between Buffalo Fork of Snake River and Yellowstone Lake. It has been popularly supposed that most of the Jackson Hole elk summer in the Yellowstone National Park, but in reality about four-fifths of them breed and spend the summer entirely south of the park boundaries and therefore within the State of Wyoming. Of these probably the majority summer north of Buffalo Fork in the State game preserve, but large numbers remain in summer in the Gros Ventre Range and in the mountains about the tributaries of Gros Ventre River. A few calve and remain all summer among the foothills and buttes close to the valley, even as low as 7,000 feet. Some summer along the east side of the Teton Range, but these are so few as to be negligible. To the south of Jackson Hole proper several hundred summer in the higher parts of Hoback Basin and descend into this valley in winter, when their numbers are augmented by the overflow from Jackson Hole.

MOVEMENTS OF ELK IN AUTUMN.

With the advance of the season in autumn the elk leave the higher altitudes where they have spent the latter part of the summer and seek lower levels. They move southward gradually, and by the time the snow becomes deep most of them desert the mountains altogether and take up their residence in the valleys. The high region north of Buffalo Fork comprising the State game preserve is then comparatively deserted by the animals, but south of that valley a few scattered bands composed mainly of old bulls pass the winter at from 7,000 to 9,000 feet, usually on northerly slopes where the snow, not being exposed to the heat of the midday sun, does not crust, but remains soft enough to permit the animals to reach the grass by pawing. In moving southward from the game preserve the animals pursue more or less definite routes. Large numbers are in the habit of going along the eastern border of Jackson Lake to the vicinity of its outlet, where they cross the narrow arm of the lake or swim the rapid river below the outlet. Of these possibly the majority cross the plains to the lower part of Jackson Hole. Other large bands cross Buffalo Fork in various places and, ascending the tributaries of Black Rock and Spread Creeks, cross to the valley of the Gros Ventre, where they arrive in numbers in November. Some of these bands, usually the later ones, remain on Black Rock and Spread Creeks during the entire winter, and two or three thousand usually pass the winter in the valley of the

Gros Ventre. The majority, however, move southeastwardly along the foothills to the lower part of Jackson Hole. In 1910 they came about the last of November. The open valley between the hills and Snake River, a part of which is known as Antelope Flats, was formerly a favorite migration route for these animals, but increasing settlement has lately caused them to seek almost entirely the shelter of the foothills to the eastward. Besides those which winter in the valley of the Gros Ventre within the mountains, a few hundred frequent the willow swamps of its lower stretches. A few winter about the upper Gros Ventre Butte (usually called the Black Tail Butte), and the low elevations, called the East and West Gros Ventre Buttes, which occupy a considerable area in the middle part of Jackson Hole, harbor a number of good-sized herds. The favorite haunt of the animals, however, is the large marsh bordering Little Gros Ventre or Flat Creek above the town of Jackson. This occupies an area about 5 miles in length and varying in width from 1 to 2 miles. Flat Creek, which traverses it, is partially dammed near the town of Jackson by a ledge of rock, and the slackened current, permitting the deposition of great quantities of silt, has caused the formation of this marsh. A rank growth of coarse grass covers the greater part of this area, much of which is so wet during ordinary seasons as to prevent harvesting. Several large warm springs drain into it, and these cause parts of the stream to remain open during most or all of the winter, but the marsh itself is partially flooded and freezes early, allowing the animals to gain access to such forage as remains above the ice and snow. During the past winter an unusually heavy fall of snow in early January was heavily crusted as the result of a wet storm and the animals were prevented from obtaining more than a small proportion of the rich store of food which should have awaited them. The surrounding hillsides, as a result of the unusually dry summer of 1910 and the consequent excessive grazing, did not afford the usual amount of food, and before the winter was half over the condition of the herds had become appalling.

DEPREDATIONS BY ELK IN WINTER.

The passage of bands of large animals through even a sparsely settled country naturally results in some damage to fences. The ordinary rail fence used for the confinement of stock offers no serious impediment to the elk, especially when snow lies deep on the ground and eddies of air about the corners of fences and in the lee of knolls form deep drifts. Thus fences which cross the routes frequented by these animals are usually broken down early in the winter. The most serious damage, however, results from the efforts of animals to reach haystacks, and in this respect the settlers find it almost impossible to protect themselves. Besides their ability to leap or scramble over high fences, the elk show great dexterity in clambering sideways between the poles and, if even a narrow space is left, they frequently force apart even strongly fastened rails. The difficulty is, of course, increased by the tendency of drifts to form about high objects like haystacks. High fences of woven wire would doubtless prove much more effective than the rail fences in common use, but the initial cost of this fencing and the difficulties of transportation have prevented its adoption. Many settlers, despairing of fencing the starving animals from the hay needed for their stock, are forced to sleep beside the stacks during much of the winter, a task which is not conducive to a tolerant view of the situation.

HABITS IN WINTER.

The life of the elk during a winter so severe as that of 1910–11 is a constant struggle to preserve existence. Following the path of least resistance, the majority of the animals, including most of the young calves, find themselves in the valley, where they are soon driven to browse on the willows and other shrubs already nearly destroyed during previous winters. The elk soon eat the smaller twigs and then are forced by hunger to attack the bark and larger branches. The woody fiber thus swallowed has little nutriment and is without doubt actually injurious, especially to the younger animals. Even sagebrush is drawn on for sustenance. Haystacks about ranches are, of course, eagerly sought. If insecurely fenced, they are soon at the mercy of the starving animals, which frequently die from overfeeding. When they find the stacks securely fenced, large numbers die immediately around them. The larger animals by standing on their hind legs may be able to reach a few morsels of hay, while the young calves in the group are trampled by their larger associates and perish miserably.

Many herds, composed mainly of adults of both sexes, sometimes accompanied by a few calves, remain on the open hillsides and among the aspen and spruce woods of the mountain slopes. Although there is usually some mortality among these herds, they fare better on the average than those which seek the valleys, since they are in smaller bands and have a larger proportion of older and experienced animals. Besides securing some withered grass, they browse on the twigs and bark of the aspen poplar and to a less extent on the spruces. Any brush left by woodchoppers is eaten at night, as the animals are freely nocturnal. Some of these bands make forays to the valleys at feeding time or during the night and return to the hills to rest.

WINTER MORTALITY OF ELK.

Apart from the death of elk from actual starvation, there is, of course, the normal mortality, most of which takes place in winter, when the conditions surrounding the animals are hardest. Even in mild winters and in times of plentiful food supply, many of the older animals of both sexes die. Owing to the fact that a large proportion of the animals killed for food during the autumn months are females, a great many young calves are left motherless and are in a more or less weakened condition when winter comes on. Furthermore, many of the late-born calves are poorly equipped to withstand the winter, and this is likely to be true also of many of the cows which have borne and nursed young the previous season.

A conservative estimate places the number of elk which died of starvation in the Jackson Hole region during the winter of 1910–11 at some 2,000 to 2,500. Of these, by far the greater number were calves of the previous year. Probably 75 per cent of the calves which came into the valley in November and December had perished of starvation before the end of the following March. In some bands the loss of calves was as high as 90 per cent, but other bands suffered less. The greater part of the loss occurred before feeding began, but large numbers, both calves and older animals, were so weak that they died even when receiving what would ordinarily have been an abundance of food. Many, in fact, on being fed after a period of starvation, die almost immediately. There is evidently little difference in the relative mortality of the sexes in adult elk, and out of 75 calves examined for sex 32 were males and 43 were females, indicating that in the case of the young the burden on the sexes is not strikingly unequal.

HABITS IN SPRING AND EARLY SUMMER.

As spring advances and the sides of hills bordering the valley become bare, the elk, especially the older animals, leave their haunts in the lower part of the valley and seek the hillsides, where they subsist on the dry grass which has been exposed by the melting of the snow. At the time of my arrival, about the middle of March, they had already begun to work back into the hills, and the numbers being fed were much less than originally. Many of the animals at this season spend a part of their time on the hillsides, visiting the feeding grounds at the time when they have been accustomed to be fed. As the spring advances, this movement into the hills becomes more and more pronounced, until the valley is entirely deserted. The last ones left that part of Jackson Hole south of the Gros Ventre Buttes, known locally as South Park, about April 26, some time after feeding of hay had been discontinued. They were subsisting on the green grass then springing up on the borders of some spring-fed creeks. They were seen on the adjacent hillsides until early May. In the swamp north of Jackson a large herd remained later. Investigation showed that they were feeding on the green leaves of the coarse marsh grass, evidently the plants which had grown in autumn after hay harvest. This grass had been kept green and succulent by its covering of ice and snow. In early May the icy flooring which had remained solid beneath the tangled grassy covering no longer held up the animals, and they all left about May 10. For some time longer upward of 100 remained on the East Gros Ventre Butte, several hundred feet higher than the valley level. Here they lived on the grasses and herbaceous plants which were fast springing up. These elk remained here until about May 25, and then part or all of them crossed westward and joined others on the larger West Gros Ventre Butte, which afforded them more protection. Upward of 100 were seen there as late as May 31, and a few remained all summer.

Some of the older bulls dropped their antlers about March 25, but the shedding continued for several weeks. Among a herd seen May 4 were a number of bulls still bearing horns, but by May 15 even the younger bulls had all dropped them. As the shedding of antlers is dependent on the general condition of the animal, the process was delayed by the severe winter and late spring. In an earlier spring following a normal winter the new horns are already well grown in May, but in 1911 that month found most of the bulls with their horns scarcely started, and in mid-August many were still in the velvet.

BIRTH OF YOUNG.

About 75 per cent of elk cows over 2 years old bear young. The majority of calves are born between the 25th of May and the middle of June. Nearly all the testimony obtained on the subject is to the effect that only one calf is born at a time. A few thought that twins sometimes occur, but it seems probable that this opinion arose from the fact that a cow elk is frequently followed by two calves during the summer, the extra one being the deserted or orphaned offspring of another cow. Many of the hunters had examined large numbers of female elk with calf, and none of these ever found more than one fetus. The proportion of the sexes at birth is nearly even. Large numbers of the cows have their young in the hills in the vicinity of Jackson Hole, but probably the majority of the animals which come from north of Buffalo Fork return there before dropping their young. This varies according to the season, an early spring allowing a greater proportion to move northward before calving. The young are usually born in a thicket, very often among aspens, and are carefully concealed by the mothers when they have occasion to leave them. The calves are said to begin to graze at the age of 4 to 6 weeks, and many are weaned in September. In some cases, however, weaning does not occur until October, November, or even later.

HABITS IN LATE SUMMER AND IN AUTUMN.

In July and August most of the elk range the mountains at an elevation of from 9,000 to 11,000 feet, where they find the least annoyance from insects. At this time the older bulls frequently range above timber line and rarely associate with the bands of cows and calves. Toward the end of August the elk seek slightly lower elevations, and the stronger bulls begin to herd the cows. The rutting is at its height from September 10 to October 1. At this time the whistling or bugling of the males, which sometimes occurs in summer, is heard in its highest perfection. At this season the cows are restless and wary, but the older bulls are less watchful than at other seasons and fall easy prey to hunters. The opening of the hunting season as early as September 1 has, therefore, a deterrent effect on the breeding of the animals. The prohibition of hunting in the region lying north of the Buffalo Fork of Snake River, comprising the State game preserve, is of great value, since large numbers of the animals are thus left undisturbed during this important period.

When the rutting season is over, the older bulls segregate and remain high in the hills after the main herds have sought lower altitudes. As has been shown, many old bulls may even winter at elevations not much below the summer habitat. As the season progresses, the cows, calves, and younger bulls slowly seek the valleys. The heavy storms of November cause them to gather in large herds and by December the bulk have congregated in the valleys. (See Plate VII.)

ENEMIES OF ELK.

One of the most destructive natural enemies of the elk, the puma or mountain lion, is now eliminated from consideration, since it is practically exterminated in the Jackson Hole region. On the other hand, wolves, which were formerly unknown there, are common and increasing. They first appeared about 10 or 12 years ago, coming in from the Green and Wind River region, probably following the introduction of stock. It is estimated that about 25 adult wolves now range in Jackson Hole. The damage inflicted by them on both horses and cattle is serious, and, as they seem to be able to kill elk at will, they must destroy a large number. They kill stock and game on the hills immediately about the settlements, both summer and winter, frequently two or more attacking the prey. They usually hamstring the elk, and after felling them make a meal from the eyes, the udder, and other choice parts, and seldom return to the carcass, preferring a fresh victim.

The coyote, unlike the wolf, is almost certainly native to the region, but has increased greatly with settlement. Adult elk are seldom or never killed by them, but a few young calves fall victims.

Wood ticks are very abundant along the trails where elk travel and in the sagebrush in which they bed, and the animals frequently

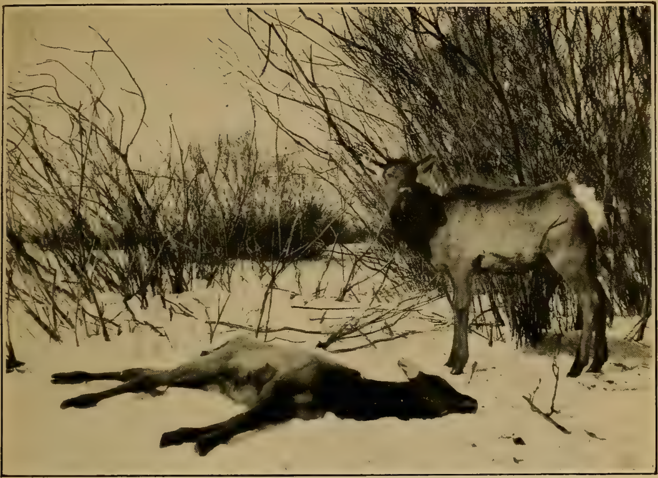


FIG. 1.—ELK CALVES IN WILLOW THICKETS. SOUTH PARK, BELOW JACKSON, LATE WINTER, 1910-11.

(Photographed by S. N. Leek.)

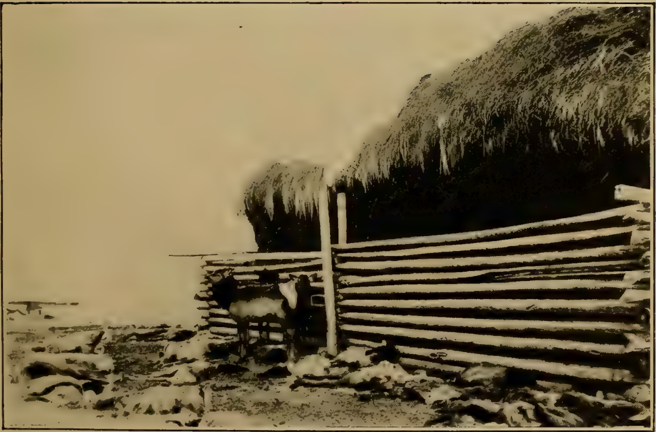
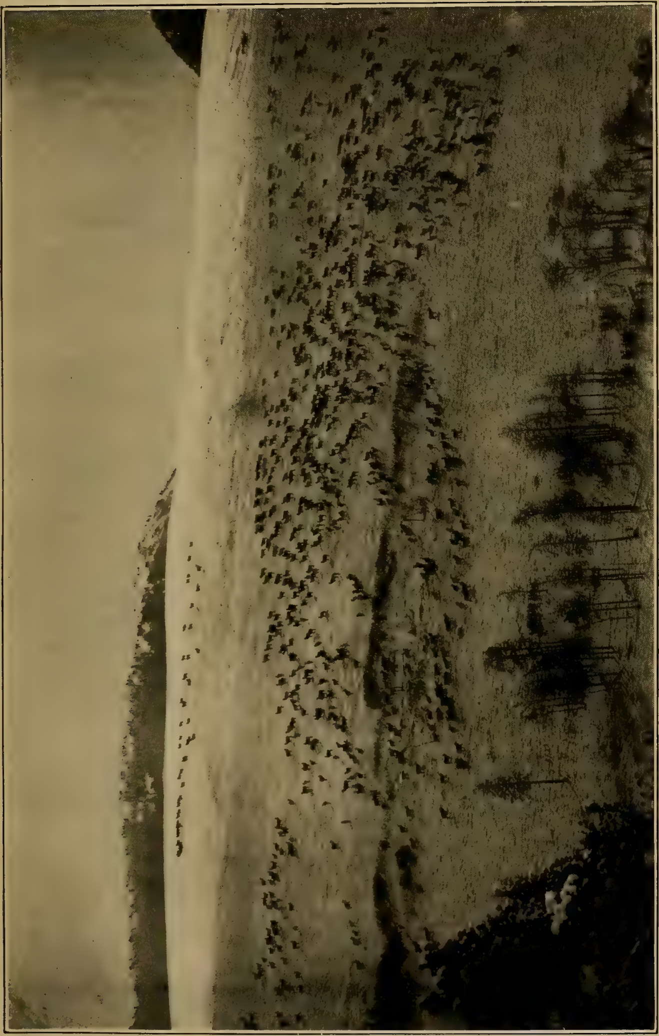


FIG. 2.—ELK CALVES, DEAD AND DYING, ABOUT FENCED HAYSTACK, NEAR JACKSON.

(Photographed by S. N. Leek.)



ELK IN THE FOOTHILLS OF JACKSON HOLE, IN EARLY WINTER, WHEN THEY HAVE JUST COME FROM THEIR SUMMER HOME IN THE MOUNTAINS.

(Photographed by S. N. Leek.)

become unwilling hosts of large numbers. It is doubtful if the elk are killed by ticks, but in the spring they are undoubtedly weakened by the pests.

ILLEGAL KILLING OF ELK.

The great majority of the people of Jackson Hole are opposed to the killing of elk contrary to law, but there is more or less illegal killing throughout the year. Some of the lawbreakers became residents of the region because of the opportunity afforded for making a living in whole or in part from game, and many of these regard the elk as their natural prey at any season. Many also are "old-timers"—men whose experience in the West antedates restrictive laws and the period when they became necessary. Others justify themselves in illegal killing "because so many of the elk die of starvation." It is hoped that the conditions which furnish this excuse may be abolished.

Lowest in the scale of all the enemies of the elk is the tusk hunter—the creature who, on the chance of gaining a dollar or two, kills one of the largest and finest of our game animals and, taking only the tusks, leaves the body to go to waste. The wolf kills that he may live, but the tusk-hunter slays only that he may escape honest labor. Under cover of the mail he forwards his booty undetected to dealers who dispose of the tusks to purchasers who seek only trophies, indifferent to how they are obtained.

The warden service in the Jackson Hole region at the present time is very inadequate. The game preserve, with an area of not less than 1,000 square miles, is little patrolled except by the Federal forest rangers, whose regular duties will not permit much attention to game interests. In addition to this there remains an area comprising at least 1,500 square miles, and this great tract of rough country is under the care of one deputy game warden with one or two assistants.

TRANSPORTATION OF ELK.

The plans of the Biological Survey contemplated the removal of a number of elk to other States, where they could be liberated on suitably protected ranges and form the nucleus of new herds.

The problem of transportation is a difficult one, because the Teton Range, 2,000 feet higher than the valley of Snake River, must be crossed on the way to the railroad. Spring, moreover, when the snow is disappearing on both sides of the range and is softening and settling on the Teton Pass, is the most unfavorable time of the year for moving live animals. The facilities for transportation were not extensive, and the number captured, therefore, was necessarily limited by the accommodations at our disposal. A dozen of the more vigorous animals of various ages were selected from a herd being fed in the southern part of Jackson Hole, and on April 12 we started with them for the railroad. Hay or alfalfa was provided for them morning and night and water at least three times daily. They readily took both food and water and were given as much of both as they wanted.

A delay of a few days would have necessitated making the first lap of the journey on wheels, then changing to sleds, and again to wheels. Fortunately, however, enough snow remained in the valley to allow the use of runners, and but one change was necessary. Racks covering the entire wagon bed were constructed, and from three to five elk were placed in each load. A decided lowering of temperature, accompanied by a snowstorm, made traveling over the Teton Pass unpleasant and arduous, but was of distinct assistance in the successful accomplishment of a task always dreaded at this season. In our case the normal difficulties were magnified by the nature of our loads, which, though not of excessive weight, were bulky and top-heavy. Similar attempts in the past have almost invariably been attended with some loss; but by constant vigilance and the hearty cooperation of our assistants the mountains were crossed without mishap. Near Victor, Idaho, close to the western base of the range, bare ground was reached, and our loads were changed from runners to wheels. This was done by lifting the wagon bed and racks by means of a derrick, without removing the animals. The roads from this point were in excellent condition, and the completion of the trip was merely a matter of time.

Upon our arrival at St. Anthony, arrangements were made at once for shipping the animals. The National Bison Range at Ravalli, Mont., and the Wichita Game Preserve in Oklahoma had been selected as the places to be supplied, and the lot was divided between them. It is gratifying to report that the animals in both shipments reached their destinations in excellent condition and that the project of reestablishing the species in these depleted localities has been successfully inaugurated.

WINTER REFUGE FOR ELK.

The establishment of a winter refuge, where the feed can be preserved by excluding stock during the summer, is essential for the proper protection of the elk. Such a refuge should be of considerable size, should be situated in a valley which the elk naturally seek, and should comprise pasture lands, as well as meadows which will produce hay for feeding the animals after they have exhausted the available forage. An ideal situation would include also a tract of somewhat elevated land, to which the animals could retire for rest.

In 1906, when increasing settlement and the attendant grazing of the mountain parks began to affect the welfare of the wintering herds of elk, Mr. D. C. Nowlin, then State game warden, suggested the setting aside of an area including a large part of the valley of the Gros Ventre River for the exclusive use of the elk and other game. Later, in his annual report for 1908, he outlined the proposed area, which was embraced by the Teton National Forest, and included several claims occupied by stock ranchers, and recommended its acquisition by the State.

Early in 1909 a joint memorial was presented to Congress by the Wyoming Legislature requesting that a tract comprising six townships of public land in the Gros Ventre region be granted to the State for a winter game refuge, and that provision be made also to acquire the holdings of the few settlers thereon located, who favored the proposition and were willing to dispose of their land at a fair price. Owing mainly to the opposition of the people of Jackson Hole, no result was obtained.

In the course of the present investigation an attempt was made to ascertain the sentiment of the people of Jackson Hole regarding winter refuges. About 40 residents of the valley, most of them living within a few miles of the town of Jackson, were asked specifically whether or not they favored the acquisition of a tract for a winter refuge. Of this number, 27 favored the securing of a tract in the settled part of the valley. Most of the remainder were in favor of feeding hay in winter, while a few believed that some area should be set aside for the elk but were indifferent as to its location. The few inhabitants of the Gros Ventre Valley were, generally speaking, in favor of the establishment there of a reserve, and several from other sections were like-minded. It is evident that, while the inhabitants of the region as a whole have heretofore violently opposed the setting aside of an elk refuge on the Gros Ventre, they are really in favor of a refuge and differ mainly as to its location, the people in the valley advocating its establishment there, while the settlers on the Gros Ventre favor that section as its site.

The Biological Survey looks on the establishment of one or more winter refuges as the best solution of the problem of properly caring for the elk in winter. An area in the lower part of the region is of prime importance, since there the greatest number of elk resort and there an area of a given size can be made to support the greatest number of animals. On the other hand, the establishment of a second refuge in the Gros Ventre Valley would be comparatively inexpensive and would gradually be the means of detaining there in autumn a considerable number of the elk which would otherwise keep on to the lower country. It has been estimated that 600 tons of hay can be harvested on the claims now occupied on the Upper Gros Ventre, and this amount, with the available forage, would support more elk than now winter there. The number which might be supported on a properly managed refuge in the Jackson region would be limited only by the size of the reservation. It is earnestly recommended that at least one winter refuge for elk be established.

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Issued March 21, 1912.

U. S. DEPARTMENT OF AGRICULTURE

BIOLOGICAL SURVEY—BULLETIN No. 41

HENRY W. HENSHAW, *Chief*

CHRONOLOGY AND INDEX

OF THE MORE IMPORTANT EVENTS IN

AMERICAN GAME PROTECTION

1776-1911

BY

T. S. PALMER

Assistant Chief, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
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THIS PUBLICATION may be procured from the Superintendent of Documents, Government Printing Office Washington, D. C., at 10 cents per copy

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., November 27, 1911.

Sir: I respectfully transmit herewith for publication as Bulletin No. 41 of the Biological Survey a Chronology and Index of the more important events in American Game Protection from 1776 to 1911, by Dr. T. S. Palmer, Assistant Chief of the Biological Survey. Requests are constantly received for information regarding various matters connected with the protection of game, and particularly as to the States which have adopted certain measures. From the information on file the following index has been prepared to answer such inquiries and also to make the facts more generally available.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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CHRONOLOGY AND INDEX OF THE MORE IMPORTANT EVENTS IN AMERICAN GAME PROTECTION, 1776-1911.

INTRODUCTION.

Game protection in the United States has been gradually developed during a period of nearly 300 years and has been marked by an immense volume of legislation. In no other country in the world have laws for the protection of game been passed in such numbers or amended so frequently. Among the characteristic features of American game legislation are the division of birds into three groups—game birds, nongame birds, and noxious species; the restrictions on hunting by nonresidents; the limitations on the quantity of game that may be killed at certain times; the prohibition of export and sale; the system of enforcement by State officers; and the maintenance of this system largely by receipts from hunting licenses.

DEFINITIONS OF GAME.

The mammals and birds which have been the subject of this extended legislation have varied considerably at different times, as have the definitions of the groups. Frank Forester, writing in 1848, declared:

> Game is an arbitrary term, implying, in its first and most correct sense, those animals, whether of fur or feather, which are the natural pursuit of certain high breeds of dogs.

Under this heading he included the bison, mountain sheep, antelope, moose, elk, caribou, deer, rabbit, varying hare, black or brown bear, and grizzly bear, and added:

> This is the utmost limit that I can assign to the quadruped game of this country; as I can not lend my humble sanction to the shooting squirrels, racoons, or opossums out of trees, and calling that sportsmanship; any more than I can assent to shooting thrushes, crow blackbirds, pigeons, meadowlarks, and reed-birds, and calling them game.

Under birds he included wild turkeys, quail, grouse, ptarmigan, coot, rail, plover, snipe, and other bay birds, woodcock, geese, swans, and ducks. (Field Sports in America, I, pp. 21, 23, 26–34.)

In 1886 the committee on protection of birds of the American Ornithologists' Union prepared a definition of game birds which, with slight modifications, has been generally accepted. This definition was based on natural groups, as follows:

> The following only shall be considered game birds: The Anatidæ, commonly known as swans, geese, brant, and river and sea ducks; the Rallidæ, commonly known as rails, coots, mudhens, and gallinules; the Limicolæ, commonly known as shore birds, plovers, surf birds, snipe, woodcock, sandpipers, tattlers, and curlews; the

Gallinæ, commonly known as wild turkeys, grouse, prairie chickens, pheasants, partridges, and quail. (Forest and Stream, XXVI, p. 84, Feb. 25, 1886.)

In 1887 the Boone and Crockett Club in its constitution defined big game as follows:

> Under the heading of American large game are included the following animals: Black and brown bear, grizzly bear, polar bear, buffalo (bison), mountain sheep, woodland caribou, barren-ground caribou, cougar, muskox, white goat, elk (wapiti), wolf (not coyote), prong-horned antelope, moose, Virginia deer, mule deer, and Columbian black-tailed deer. (Art. IV.)

In 1898 the list was modified by omitting the wolf.

In 1900 the Biological Survey, utilizing these definitions, limited the term, so far as applied to North American species, to four well-marked groups of mammals and four of birds, namely: 1, ruminants and peccaries (Ungulata); 2, bears and raccoons (Carnivora); 3, rabbits and squirrels (Rodentia); 4, opossums (Marsupialia); 5, swans, geese, brant, and ducks (Anatidæ); 6, rails, coots, mudhens, and gallinules (Rallidæ); 7, shorebirds, including plover, woodcock, sandpipers, and curlews (Limicolæ); 8, wild turkeys, grouse, pheasants, partridges, and quail (Gallinæ). (Biol. Survey, Bull. No. 14, p. 11, 1900.)

The extent to which definitions have been incorporated in statutory law shows even greater variations. In the English laws game is defined as "hares, pheasants, partridges, grouse, heath or moor game, black game, and bustards" (Game Act, 1831, sec. 2), while the term ground game is applied to hares and rabbits (Ground Game Act, 1880, sec. 8). Game proper thus includes only the Gallinæ and the Otididæ (bustards). Deer, waterfowl, and shore birds are not included, and protection of shore birds and wild fowl is provided under the Wild Birds' Protection Act of 1880.

In Bouvier's Law Dictionary game is defined as "Birds and beasts of a wild nature obtained by fowling and hunting," and in the Code of Mississippi as "All kinds of animals and birds found in the state of nature commonly so-called." Game birds are defined in the law of Michigan of 1899 as "Any birds protected by this act," and a law of Maine enacted the same year declares the term "shall be construed to mean the ruffed grouse or partridge, all species of the pheasant, woodcock, snipe, plover, and rail, and all ducks enumerated in this act. The term game animals shall be construed to mean moose, caribou, and deer." (Acts, 1899, ch. 42, sec. 50.)

Since 1886 the definition of game birds recommended by the American Ornithologists' Union has been incorporated in the laws of a number of States, so that at present there is general uniformity in limiting the term to four natural groups. In some States, however, the list is modified by the addition of a few species. California adds the glossy ibis; Pennsylvania, New Jersey, Delaware, and the District of Columbia, the reedbird and blackbird; a few States, the robin; and a number of States in the South and West, the dove.

DEVELOPMENT OF GAME LAWS.

The history of the development of the complex game laws of to-day from the simple provisions of colonial times is both interesting and valuable in showing the numerous experiments which have been tried and have resulted in failure, and in throwing light on present problems. Many provisions, such as restrictions on sale and export, considered recent, are in reality very old; while, on the other hand, legislation prohibiting spring shooting of waterfowl and summer shooting of woodcock and shore birds is comparatively recent, owing in large measure to the generally accepted, but erroneous, idea that migratory birds require little protection and may be shot as long as they are present in spring and as soon as they appear in late summer.

The earliest game laws were probably the hunting privileges granted in 1629 by the West India Co. to persons planting colonies in New Netherlands, and the provisions regarding the right of hunting in the Massachusetts Bay Colonial Ordinance of 1647 and the New Jersey Concessions of Agreements of 1678. The years intervening between 1629 and 1911 may be conveniently divided into two periods of approximately equal length—a colonial period and a modern period. The latter period is the more important and the one with which we are mainly concerned. In the century and a third since the Revolution a vast number of experiments have been made in game protection. Many of the laws passed were soon repealed and are now forgotten, but some contained suggestions which are still valuable. The object of the present publication is to furnish access to the more important ideas, to show briefly the development of the present system, and to direct attention to some of the more important facts in the history of game protection.

The index is in no sense a complete index to the mass of statute law enacted since 1776, but merely a guide to some of the more important provisions. In order to keep the subject matter within reasonable limits it has been restricted chiefly to legislation, decisions of the courts, and organization of the more important game protective associations and the game warden service in the several States. A few other facts of general interest have been incorporated, such as the dates of introduction or extermination of some of the more important species; the dates of publication of some of the more important works dealing with legislation or the history of game protection, establishment of public parks and private preserves, and the origin of certain ideas which have had an effect on the protection of game.

At the end of the colonial period 12 colonies had enacted game laws. Close seasons had been provided for deer in all the colonies except Georgia; and for wild turkeys, heath hens, partridges, and quail in New York. Several of the colonies had laws prohibiting hunting on Sunday or hunting with fire at night. Massachusetts in

1710 had prohibited the use of boats or canoes with sails, or canoes disguised with hay, sedge, or seaweed for hunting waterfowl. Restrictions on export and sale of deer skins were also in force in some of the colonies. The beginnings of the warden system had been made in Massachusetts and New Hampshire about the middle of the eighteenth century, but these comparatively few statutes were all that were considered necessary.

By 1800 the number of States which had found it desirable to pass game legislation had been increased from 12 to 14 by the addition of Vermont and Georgia.

By 1850 comparatively little game legislation had been enacted, although the list of States having such laws had increased to 19, which included the thirteen original States and Maine, Vermont, Florida, Alabama, Mississippi, and Indian Territory, thus comprising all the States along the coast from the New Brunswick boundary to the mouth of the Mississippi River, together with Indian Territory. The only game law in force west of the Mississippi was the restriction on hunting on Indian lands. No protection for nongame birds was provided until the passage of the first laws protecting insectivorous birds in Connecticut and New Jersey in 1850.

In the decade from 1851 to 1860 game laws were passed for the first time in 12 States, increasing the total number to 31. These States included Illinois, Indiana, Michigan, Ohio, and Wisconsin, east of the Mississippi River; Minnesota, Iowa, Missouri, Nebraska, and California in the West; and Louisiana and Texas in the South. The first law prohibiting the use of ferrets in hunting rabbits was passed in Rhode Island in 1860. The only provision for warden service was for local moose wardens in Maine in 1852.

In the decade from 1861 to 1870 the list of States was still further increased by 10. The chief advance was in the Rocky Mountain States—in Colorado, Idaho, Montana, and Wyoming; farther west in Nevada and Washington; and in the Middle West in Kansas, Kentucky, Tennessee, and West Virginia. The first efforts to restrict spring shooting were made in Ohio,[1] 1861, and Michigan, 1863 and 1869; and shooting waterfowl from blinds placed in open water was prohibited locally in North Carolina in 1870.

In the decade from 1871 to 1880 the progress of game legislation extended to 48 States by the addition of North and South Dakota, Utah, and Oregon in the West; Arkansas and New Mexico in the South; and the District of Columbia in the East. The waste of game (Wyoming, 1871) and hide hunting (Oregon, 1874) were prohibited, and the first statutes were enacted limiting bags of game birds (Iowa, 1878) and providing rest days for wildfowl (Maryland,

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[1] This law (Acts 1861, p. 173) was local. Earlier laws covering a few species were enacted in Rhode Island in 1846 and in Michigan in 1859. The former prohibited spring shooting of wood duck, black duck, woodcock, and snipe; the latter restricted killing of mallard and teal.

1872, and New Jersey, 1879). Destructive methods of hunting wildfowl were restricted by prohibiting the use of boats propelled by steam or sail (New Jersey, 1879), and market hunting was prohibited (Arkansas, 1875). This period also marked the beginning of the nonresident license legislation (New Jersey, 1873, and Delaware, 1879) and the establishment of the first game commissions (California and New Hampshire, 1878). The first publication of the game laws in pamphlet form appeared in New York in 1873.

In the decade from 1881 to 1890 the first game laws were passed in the Territories of Arizona and Oklahoma. Measures were adopted prohibiting hunting in the snow (Delaware, 1887), on highways (Kansas, 1886), or for millinery purposes (Wisconsin, 1887). The first salaried wardens were appointed (Michigan, Minnesota, and Wisconsin, 1887). The model law for the protection of nongame birds was enacted in two States (New York, 1886, and Pennsylvania, 1889).

The decade 1891 to 1900 was marked by the first real Federal legislation. In 1900 the earliest game provision for Alaska was incorporated in the Alaska Civil Code, although the first general game law for the Territory did not pass until 1902. The year 1900 also marked the final passage of the earliest general Federal statute, commonly known as the Lacey Act, which became a law after being under consideration by Congress for three years. Jacking deer (New York, 1897) and dove baiting (Georgia, 1898) were prohibited, and training dogs on game birds was regulated (Michigan, 1891). The modern system of hunting licenses was established by provision for resident and nonresident licenses in 1895 in several States and for guide licenses in Maine, 1897, and Wyoming, 1899.

In the decade from 1901 to 1910 a number of new restrictions were placed on the statute books, among which may be mentioned prohibition of the use of automatic guns (Pennsylvania, 1907) and silencers (Maine, North Dakota, and Washington, 1909), the requirement of a license to photograph big game in winter (Wyoming, 1905), and provision for paying for damages to crops by deer (Vermont, 1902). The propagation of game has received widespread attention through the so-called "more game movement" inaugurated in 1908.

New impetus was given to game protection through the establishment of sportsmen's journals in the early seventies, and this movement was almost immediately reflected in an increased volume of legislation; so that during the last three decades of the century the number of laws rapidly increased.

GAME LAWS ENACTED 1901 TO 1910.

The following table shows the number of game laws enacted during the decade from 1901 to 1910. A cipher indicates that there was no legislative session in the State for that year and a dotted line signifies that although the legislature was in session no game law was passed.

Number of game laws enacted, 1901–1910.

State.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Total.
Alabama	28	0	6	0	0	0	1	0	0	0	35
Alaska	......	1	......	......	......	......	......	1	......	......	2
Arizona	1	0	1	0	2	0	......	0	1	0	5
Arkansas	4	0	5	0	6	0	5	0	7	0	27
California	4	0	1	0	6	0	4	0	11	0	26
Colorado	1	0	2	0	1	0	3	0	2	0	9
Connecticut	4	0	6	0	5	0	4	0	6	0	25
Delaware	3	0	1	0	2	0	1	0	5	0	12
District of Columbia	1	......	......	......	......	1	......	......	......	......	2
Florida	2	0	4	0	5	0	5	0	1	0	17
Georgia	1	1	4	1	1	......	......	1	......	......	9
Idaho	......	0	1	0	1	0	3	0	3	0	8
Illinois	1	0	1	0	1	0	1	0	1	1	6
Indiana	1	0	1	0	2	0	3	0	2	0	9
Iowa	0	1	0	4	0	2	1	0	3	0	11
Kansas	1	0	4	0	3	0	5	1	1	0	15
Kentucky	0	3	0	4	0	1	0	......	0	1	9
Louisiana	0	1	0	2	0	3	0	2	0	6	14
Maine	13	0	14	0	5	0	4	0	8	0	44
Maryland	0	25	0	18	0	18	0	19	0	10	90
Massachusetts	5	5	7	5	8	10	11	8	12	9	80
Michigan	5	0	3	0	4	0	15	0	3	0	30
Minnesota	5	1	1	0	3	0	3	0	5	0	18
Mississippi	0	......	0	1	0	1	0	......	0	2	4
Missouri	1	0	......	0	1	0	2	0	1	0	5
Montana	2	0	4	0	2	0	6	0	5	0	19
Nebraska	1	0	......	0	1	0	1	0	1	0	4
Nevada	3	0	2	0	1	0	......	0	2	0	8
New Hampshire	3	0	4	0	......	0	4	0	9	0	20
New Jersey	2	7	3	6	1	1	3	7	3	5	38
New Mexico	2	0	1	0	1	0	1	0	1	0	6
New York	12	13	17	11	16	6	6	2	4	7	94
North Carolina	38	0	54	0	67	0	71	7	79	0	316
North Dakota	3	0	1	0	......	0	......	0	2	0	6
Ohio	0	1	0	1	0	......	0	2	......	1	5
Oklahoma	......	0	1	0	1	0	......	......	2	4	8
Oregon	1	0	2	0	7	0	4	0	1	0	15
Pennsylvania	7	0	5	0	3	0	7	0	2	0	24
Rhode Island	2	0	1	2	3	1	2	2	1	3	17
South Carolina	......	1	1	......	5	3	2	4	......	2	18
South Dakota	2	0	3	0	1	0	2	1	2	0	11
Tennessee	24	0	9	0	9	0	1	0	8	0	51
Texas	1	0	3	0	2	0	2	0	1	0	9
Utah	1	0	1	0	1	0	1	0	1	0	5
Vermont	0	2	0	6	0	5	0	9	0	12	34
Virginia	0	23	2	4	0	3	0	4	0	2	38
Washington	2	0	3	0	3	0	1	0	7	0	16
West Virginia	1	0	1	0	......	0	1	0	1	0	4
Wisconsin	3	0	3	0	7	0	17	0	1	0	31
Wyoming	2	0	1	0	3	0	4	0	5	0	15
Total	193	85	184	65	190	55	207	70	210	64	1,324

The total number of laws, exclusive of bounty laws and appropriation acts, was 1,324, an average of about 133 per annum, or 265 for each biennial period. The States which have passed the greatest number of game laws during these years were North Carolina, 316; New York, 94; Maryland, 90; Massachusetts, 80; and Tennessee, 51. Those which have passed the smallest number were Alaska and District of Columbia, 2 each; Mississippi, Nebraska, and West Virginia, 4 each; Arizona, Missouri, Ohio, and Utah, 5 each. These numbers do not indicate the amount of game legislation so much as the difference in manner of enactment, some States making each special provision or local law a separate act, while others group all the game legislation of a session in a single act. The figures are chiefly of relative value. Absolute accuracy is difficult of attainment, both because game measures are occasionally embodied in laws relating to other subjects and because in case of certain measures there is room for difference of opinion as to whether they should or should not be considered game laws. The numbers are conservative, however, and the totals show less, rather than more, than the actual number of laws passed.

SUMMARY OF GAME PROTECTION BY STATES.

In the following table the dates of adoption of 10 of the more important features of the game law are shown for each State, from the earliest dates to 1910. Figures in black-face type indicate the first enactment of the kind.

Summary of game protection by States.

State.	First game law.	Deer.		Spring shooting prohibited (waterfowl).	Non-game birds (model law).	Bag limits.	Export.	Sale prohibited (all protected game).	Resident licenses.	State wardens.
		(Does protected).	Hounding prohibited.							
Alabama	1822	1907	....	....	1907	1907	1907	1907	1907	1907
Alaska	1900	1902	1902	1902	1902	1902	1900	....	1908	....
Arizona	1887	1897	....	1887	....	1901	1893	1903	....	1887
Arkansas	1875	....	....	....	1897	....	1889	1903	....	....
California	1852	1883	1901	1901	1905	1901	1895	....	1907	**1878**
Colorado	1867	1899	1891	....	1903	1891	1891	....	1903	1891
Connecticut	**1677**	1893	....	1907	1901	1899	**1677**	....	1907	1895
Delaware	1721	....	....	....	1901	....	1891	....	....	1879
District of Columbia	1878	....	....	....	1901	....	....	....	....	....
Florida	1828	....	....	....	1901	1895	1893	....	....	....
Georgia	1790	....	....	....	1903	1903	1899	....	1911	1911
Idaho	1864	....	1883	1903	....	1899	1899	1899	1903	1899
Illinois	1853	1899	....	....	1899	1903	1879	1899	1903	1899
Indiana	1857	....	1879	....	1891	1901	1879	....	1903	1899
Iowa	1857	1898	....	....	1907	**1878**	1878	....	1909	1897
Kansas	1861	1908	....	....	....	1905	1876	1897	1905	1905
Kentucky	1861	....	[1] 1872	....	1902	....	1904	....	....	....
Louisiana	1857	1904	....	....	1904	1904	1904	....	1908	1908
Maine	1830	....	1883	1901	1901	1883	1899	....	....	1880
Maryland	1730	....	....	....	....	1910	....	....	....	1896
Massachusetts	1694	1898	1902	[1] 1870	**1886**	1910	1886	....	1908	1886
Michigan	1859	....	1887	[1] 1859	1905	1895	1881	1901	**1895**	1887
Minnesota	1858	....	1889	1899	1903	1891	1871	1901	1899	1887
Mississippi	1803	1906	....	....	1904	1906	1906	1906	....	....
Missouri	1851	1905	....	....	1905	1905	1877	1905	1905	1895
Montana	1870	....	1887	1905	....	1897	1885	1897	1905	1895
Nebraska	1860	1901	....	....	....	1901	1897	1907	1901	1901
Nevada	1861	1901	[1] 1903	1903	....	1901	1899	1901	....	....
New Hampshire	1741	....	1895	1885	1901	1899	1885	....	1909	**1878**
New Jersey	1722	1909	1909	1908	1901	1903	1901	....	1909	1894
New Mexico	1880	1903	....	....	....	1903	1895	1897	1909	1903
New York	1705	....	**1788**	1903	**1886**	1886	1900	1911	1908	1888
North Carolina	1738	....	....	....	1903	1907	1877	....	....	1903
North Dakota	1875	....	1891	1899	1909	1887	1887	....	**1895**	1895
Ohio	1857	....	....	[1] 1900	1902	1902	1894	1908	....	1886
Oklahoma	1890	1895	1909	....	1909	1909	1899	1903	1909	1899
Oregon	1872	....	1899	1905	1903	1898	1905	....	1905	1893
Pennsylvania	1721	1907	1878	[1] 1883	1889	1897	1881	....	....	1895
Rhode Island	....	1900	....	[1] **1846**	1900	....	1900	....	1909	1899
South Carolina	1755	[1] 1910	....	....	1905	1910	1900	....	....	1905
South Dakota	1875	....	1901	....	1907	1887	1887	....	1901	1909
Tennessee	1870	1905	....	....	1903	1905	1897	....	1901	1903
Texas	1860	1903	....	....	1903	1903	1897	1897	1909	1907
Utah	1872	[1] 1896	1890	1897	....	1901	1896	....	1907	1897
Vermont	1779	1865	1896	1890	1892	1896	1884	....	1908	1892
Virginia	1699	[1] **1738**	....	....	1903	....	1903	....	....	....
Washington	1865	....	1890	1897	1903	1879	1897	....	1901	1890
West Virginia	1868	1909	1868	[1] 1875	1907	1899	1891	1909	[1] 1909	1897
Wisconsin	1851	....	1876	1887	1901	1897	1887	1903	1897	1891
Wyoming	1869	....	1899	....	1901	1890	1899	....	1899	1895

[1] Repealed.

LOCAL LAWS.

In several of the States protection of game was first afforded in the form of local laws. Thus the first law in Texas established a close season for quail on Galveston Island; the first in California applied to only a few counties; in Louisiana, to St. Bernard Parish; in Missouri, to St. Louis County; and in New York, to the counties on Long Island and near New York City; while an early law of Mississippi was one authorizing police boards of counties to pass ordinances for the protection of game. The first close seasons in Alabama were established in three counties in the southwestern part of the State. As time went on, local laws in some States increased greatly in number and resulted in considerable confusion. Such legislation was especially popular in Alabama, Kentucky, Maryland, Mississippi, North Carolina, Pennsylvania, Tennessee, Texas, and Virginia. Many of these local laws are comparatively recent, having been enacted within the last 25 years. In Tennessee under the constitution of 1870 and in Texas under the constitution of 1875 special provisions were made permitting local game legislation. On the other hand, several of the States prohibited local legislation by constitutional provisions, notably Pennsylvania in 1874, Kentucky in 1894, and Alabama in 1901, thus putting an end to the complexity of local regulations and greatly simplifying the game laws in these States. Congress in 1886 adopted a general provision prohibiting local game laws in any of the Territories, a provision incorporated in the constitutions of the Dakotas, Montana, and possibly one or two other States admitted about that time. Recently both Virginia and Tennessee repealed most of their local laws and substituted general statutes, and at the present time comparatively few States depend on local legislation for the protection of their game.

CLOSE SEASONS.

It is interesting to note the gradual adoption of the close season as a means for the protection of various kinds of game during the 204 years from 1694 to 1898. Following are the dates of the first close seasons for various kinds of game, beginning with deer in Massachusetts and ending with European partridges in Vermont in 1898:

1694. Deer (Massachusetts).
1708. Heath hens, ruffed grouse, quail, wild turkeys (New York).
1791. Woodcock (New York).
1818. Snipe (Massachusetts).
1820. Rabbits (New Jersey).
1830. Moose (Maine).
1841. Squirrels (Pennsylvania).
1846. Ducks (Rhode Island).
1850. Doves (Connecticut and New Jersey)
1851. Prairie chickens (Wisconsin).
1852. Antelope, elk (California).
1859. Rail (Pennsylvania).
1861. Goats, sheep (Nevada).
1864. Buffalo (Idaho).
1870. Caribou (Maine).
1882. Introduced pheasants (Oregon).
1898. European partridges (Vermont).

The progress made in gradually shortening the open seasons may be illustrated by comparing the deer seasons first established in the Atlantic Coast States with those in effect in 1910:

State.	Original open season.	Number of days.	Open season for 1910.	Number of days.[1]
Maine	1830, Sept. 1–Jan. 1	122	Oct. 1–Dec. 15	65
New Hampshire	1741, Aug. 1–Jan. 1	153	Oct. 1–Dec. 1	52
Vermont	1779, June 10–Jan. 10	224	Oct. 25–31	6
Massachusetts	1694, July 1–Jan. 1	184	Nov. 21–27	6
Rhode Island			No open season	None.
Connecticut	1698, July 15–Jan. 15	184	do	None.
New York	1705, Aug. 1–Jan. 1	153	Sept. 16–Nov. 1	38
New Jersey	1722, July 1–Jan. 1	184	5 days open	5
Pennsylvania	1721, July 1–Jan. 1	184	Nov. 15–Dec. 1	13
Delaware	do	184	Deer exterminated	
Maryland	1730, Aug. 1–Jan. 1	153	Nov. 10–Jan. 1 (Allegany Co.)	44
			Oct. 1–Jan. 1 (Garrett Co.)	79
Virginia	1699, Aug. 1–Feb. 1	184	Sept. 1–Dec. 1	78
North Carolina	1738, July 15–Feb. 15	215	Oct. 1–Feb. 1	105
South Carolina	1769, Aug. 1–Jan. 1	153	Nov. 1–Feb. 1	79
Georgia	1850, Aug. 1–Apr. 1[2]	243	July 15–Jan. 1	145
Florida	1877, Sept. 1–Apr. 1	212	Nov. 1–Feb. 1	79

[1] Exclusive of Sundays, on which hunting is now prohibited in all these States.
[2] Richmond County only.

CLOSE TERMS.

Early in the history of the country, in some localities where game was becoming exterminated, hunting was suspended for a term of years in order to afford opportunity for recuperation. These close terms were later extended to so many States that in some cases the species received absolute protection throughout its range in the United States. The first close terms were apparently those for deer for 3 years in Massachusetts, 1718, and 4 years in Virginia in 1772. Later a similar suspension of the hunting season occurred in three counties of Massachusetts for a term of 5 years in 1818, New Jersey in 1862, and in Vermont for 32 years from 1865 to 1897. Comparatively few close terms for quail have been established in States well within the range of the species, although such periods are common in localities where birds have been introduced, or reach the border of their natural range, where they are likely to be winter killed. In the case of doves the species was first removed from the game list in Connecticut and New Jersey in 1850, and has since been given complete protection in about a third of the Northern States, although in the South and Southwest it is still retained on the game list.

By the establishment of a close term on caribou in Minnesota in 1905, the last State which had any of this game was closed to hunting, and caribou were practically removed from the game list in the United States.

Close terms for antelope have likewise been extended and adopted by successive States until in 1909 they covered the entire range of the species, thus practically removing antelope from the game list.

DEVELOPMENT OF THE PROTECTION OF GAME BY SPECIES.

The progress in extending protection to the more important kinds of game is shown in the following table:

Development of the protection of game by species.

Species.	First close season.	First close term.	First bag limit.	Protection in 1910.
Antelope	California (12 counties), 1852. California, 1854.	California, 1883	Wyoming, 1890	17 States, no open season.
Buffalo	Idaho, 1864	Colorado (10 years), 1887.	South Dakota, 1901	
Caribou	Maine, 1870	New Hampshire, 1878	Maine, 1883	Throughout range.
Deer	Massachusetts, 1693	Massachusetts, 1718	do	47 States.
Elk	California (12 counties), 1852. California, 1854.	Michigan, 1879	Wyoming, 1890	Throughout range.
Moose	Maine, 1830	Long Island (5 years), 1869.	Maine, 1883	Do.
Mountain goat	Nevada, 1861	Colorado (10 years), 1887.	Washington, 1897	Do.
Mountain sheep	do	Colorado (10 years), 1885.	Wyoming, 1890	12 States.
Rabbit	New Jersey, 1820	None	Wisconsin, 1903	17 States and District of Columbia.
Squirrel	Pennsylvania (5 counties), 1841.	Nebraska, 1905	Ohio and Vermont, 1902.	28 States.
Dove	New Jersey, 1850	New Jersey, 1850	Minnesota, 1897	44 States, 20 no open season.
Duck	Rhode Island, 1846	Louisiana (wood duck, 5 years), 1904.	Dakota, 1887	44 States.
Introd. pheasant	Oregon, 1882	Oregon, 1882	Oregon (1 county), 1901.	41 States.
Prairie chicken	Wisconsin, 1851	New Jersey (5 years), 1866.	Iowa, 1878	Throughout range.
Quail	New York, 1708	Texas (Galveston Island), 1860. Minnesota, 1861	do	48 States.
Rail	Pennsylvania, 1859 Delaware, 1859	None	Connecticut, 1899	33 States.
Ruffed grouse	New York, 1708	New Jersey (3 years), 1869.	Iowa, 1878	Throughout range.
Snipe	Massachusetts, 1818	None	do	40 States.
Wild turkey	New York, 1708	New Jersey, 1874	Florida, 1895	26 States.
Woodcock	New York, 1791	Oregon (5 years), 1901	Iowa, 1878	30 States.
Nongame	Connecticut and New Jersey, 1850.	Connecticut and New Jersey, 1850.		40 States (model law).

Restrictions on the capture of game by prohibiting certain destructive methods, limiting the amount that may be killed, restricting hunting to special days, or extending special protection to females of certain species have been adopted from time to time as necessity for such action became apparent. An interesting illustration is the legislation to prevent hunting deer by firelight. Apparently the first law of this kind was passed in Maryland in 1730, and similar statutes were enacted by each of the coast States from Maryland to Mississippi, ending with Florida in 1828. The dates of the adoption of these laws are shown in the following table:

	Year.		Year.
Maryland	1730	Virginia	1792
South Carolina	1769	Mississippi	1803
North Carolina	1777	Alabama	1822
Georgia	1790	Florida	1828

WARDEN SERVICE.

In early days the enforcement of the game law was left to local peace officers or intrusted to certain general officers. Thus New York as late as 1820 intrusted the duties of suing for penalties under the game law to overseers of the poor. In recent years, however, special officers, known as wardens or protectors, have been found necessary. The earliest officers of this kind seem to have been the deer wardens of Massachusetts, 1739, and New Hampshire, 1741, afterwards known as deer reeves in Massachusetts, 1764. Later these were followed by the moose wardens in Maine, in 1852. Shortly after the establishment of fish commissions their duties were extended to include game (beginning in California and New Hampshire in 1878), and a few years later the first appointments of salaried State game wardens were made in Michigan, Minnesota, and Wisconsin in 1887. This system has spread until at the present time it is in force in 41 States.

GAME-PROTECTION FUNDS.

In order to meet the expenses incident to game protection, and particularly to warden service, special funds were found necessary, and such funds were often set aside as game-protection funds. Thus the laws of several states contain the provision that the money received from licenses and fines shall form a game-protection fund and be applied to the payment of wardens. With the adoption of license systems these funds have assumed greater importance and are often of considerable size, amounting in several States in recent years to upwards of $100,000 per annum. The possession of such funds and the ease with which they may be collected have proved a source of weakness as well as strength to the game-warden departments, and there has been a tendency recently toward a reaction in requiring a direct appropriation by the legislature before any part of such funds can be applied to game protection. Acts have also been passed transferring to the State treasury or applying to other purposes what is regarded as a surplus.

FAILURE OF LEGISLATION TO SAVE THE BUFFALO AND WILD PIGEON.

The completion of the Union Pacific Railroad in 1868 determined the fate of the buffalo. The species at that time was distributed chiefly on the Great Plains region between the Missouri River and the Rocky Mountains, although a few individuals may have ranged west of the mountains. The only State which afforded the species any protection was Idaho. The building of the railroad not only divided the buffalo into two great herds, a northern and a southern, but gave ready access to the hunting grounds and afforded easy means of shipment for hides. For a time the slaughter raged almost uninterruptedly, and in six years the southern herd was almost exterminated. With the completion of the Northern Pacific Railroad in 1881 the fate of the northern herd was hastened, and practically the last survivors were destroyed seven years later.

It is interesting to note that a close season was first established in Idaho in 1864, in Wyoming in 1871, followed by Montana in 1872, Nebraska, 1875, Colorado, 1877, New Mexico, 1880, North and South Dakota, 1883. Neither Kansas nor Texas ever established any close season, the reason for which is apparent. With the building of the Kansas Pacific and the Atchison, Topeka & Santa Fe Railroads in the early seventies, an important trade in buffalo hides and meat arose at several points in southern Kansas, notably at Dodge City, Leavenworth, and Wichita. From these centers persistent and concerted attacks were made on the southern herd between 1871 and 1874; and so long as buffalo killing remained profitable it was impossible to secure any legislation which would interfere with the traffic. With the disappearance of the southern herd about 1874 the need for a close season vanished. Briefly stated, not the slightest protection was afforded in the way of legislation in the States in which buffalo were most abundant and in which, through its accessibility, the species was most quickly exterminated.

The enormous flocks of wild pigeons which formerly darkened the skies in the States of the upper Mississippi Valley, New York, and southern New England had already begun to decrease by the middle of the last century. The last great nesting in New York occurred in 1868, the last large roosting in 1875, and the last great nesting in Michigan—probably the last anywhere on the continent—in 1878. During the time of abundance no serious effort was made to protect the birds. The first legislation on wild pigeons seems to have been an act passed in Massachusetts in 1848, which, instead of protecting the birds, protected the netters against molestation in carrying on their business. In 1857 a committee of the State Legislature of Ohio in their report on a game bill declared:

> The passenger pigeon needs no protection. Wonderfully prolific, having the vast forests of the North as its breeding grounds, travelling hundreds of miles in search of food, it is here to-day and elsewhere to-morrow, and no ordinary destruction can lessen them or be missed from the myriads that are yearly produced.

The last wild pigeon in Ohio was killed March 24, 1900, near Sargents, Pike County (Dawson, Birds of Ohio, p. 427, 1903), and 10 years later the sole survivor of the species known was a captive bird in the gardens of the Zoological Society of Cincinnati.

Wild pigeon nesting and roosting grounds were first protected in New York in 1862 by a provision prohibiting persons from disturbing the birds by discharging firearms within a mile of their roosts. Similar legislation was enacted in Michigan in 1869 and in Pennsylvania in 1878. The first close season seems to have been provided in Massachusetts about 1870. Thus it will be seen that the birds were not fully protected even during their breeding season until after the last of their great nesting colonies had been wiped out, and then even these colonies were not protected in New York and Michigan until 10 years before the practical disappearance of the bird as an abundant species.

It is sometimes said that game legislation will not save a species from destruction, and that this fact is shown by the history of the buffalo and the pigeon. The most casual examination of their history will show that game legislation played no part in the fate of these species. A close season during the period of reproduction was denied them until too late, and even then there was little serious attempt to enforce the laws. Such legislation as existed was enacted before the establishment of an effective warden force, and the efforts at enforcement met with scanty support. (See Roney, Am. Field, X, p. 345, Jan. 11, 1879).

CHRONOLOGY OF GAME PROTECTION IN THE UNITED STATES, 1776–1911.

1776. **Pennsylvania.**—Constitutional provision that inhabitants of the State "shall have liberty to fowl and hunt in seasonable times on lands they hold, and all other lands therein not inclosed."

Virginia.—Expiration on Aug. 1 of first close term on deer for 4 years. (Henning's Stats., vol. 8, p. 591.)

1777. **North Carolina.**—Law prohibiting hunting at night by firelight (chap. 22).

1778. **New Hampshire.**—Act protecting deer, Jan. 1 to Aug. 1, and requiring towns to select two persons each year to enforce the law. (Laws 1776–80, p. 135.)

1779. **North Carolina.**—Act prohibiting hunting at night with gun and firelight.

Vermont.—First game law, protecting deer from Jan. 10 to June 10 (p. 58).

1780. **Vermont.**—Act regulating fines and changing them from continental currency to English currency.

1784. **North Carolina.**—Law prohibiting fire hunting under penalty of 39 lashes, prohibiting slaves from hunting, and forbidding hunting without permission on posted lands east of the Appalachian Mountains (chap. 33).

1785. **New York.**—Law protecting deer (from Dec. 1 to Sept. 1) and heath hens (from Apr. 1 to Oct. 1) (chap. 31).

South Carolina.—Law prohibiting fire hunting for 3 years (No. 1299, p. 719).

1787. **[Tennessee].**—Act providing for payment in skins of salaries of State officers. "Be it enacted by the General Assembly of the State of Franklin . . . that from and after the first day of January 1788, the salaries of this Commonwealth be as follows, to wit: His Excellency, the Governor, per annum 100 deer skins. His Honor the Chief Justice 500 deer skins. The Secretary to his Excellency the Governor 500 raccoon skins," etc.

1788. **New York.**—Deer law, close season Jan. 1 to Aug. 1; possession of green skins prima facie evidence of guilt; hunting deer with bloodhounds or beagles (except in Suffolk County) prohibited (chap. 82).

1789. **South Carolina.**—Law prohibiting fire hunting, and protecting does from Mar. 1 to Sept. 1. Captains of militia to read act to their companies every 6 months. (No. 1463, p. 124.)

1790. **Georgia.**—First game law, prohibiting fire hunting. (Prince's Digest, p. 341.)

1791. **New York.**—Law protecting heath hen in Queens and Suffolk Counties, Apr. 1–Oct. 5; partridge and quail in Queens, Kings, and New York, Apr. 1 to Oct. 5; and woodcock in Queens, Kings, and New York, Feb. 20 to July 1 (chap. 9).

1792. **Virginia.**—Law prohibiting fire hunting for deer (chap. 50, sec 1).

1795. **Delaware.**—Law reenacting prohibition of Sunday hunting (first law was enacted in 1750). (Rev. 1829, p. 483.)

1797. **Vermont.**—Amendment to the deer law changing the close season to Jan. 10 to July 1 (chap. 44), and protecting muskrats in June, July, and August (chap. 43).

1798. **New Jersey.**—Laws prohibiting Sunday hunting (p. 329), and providing for flogging of slaves found hunting on Sunday (p. 307).

1801. **Vermont.**—Act repealing protection of muskrats passed in 1797 (p. 105).

Virginia.—Law protecting deer from Jan. 1 to Aug. 1. (Shepherd's Stats., vol. 2, p. 276.)

1802. Massachusetts.—Law protecting deer Jan. 1 to Aug. 1, permitting capture of deer in private parks or islands at any time and prohibiting hounding in Barnstable county. (Laws 1780–1807, p. 70.)

1803. Mississippi Territory (including Alabama).—First game law prohibiting fire hunting; each slave discovered fire hunting to receive 39 lashes and his master to pay $10; captains of militia to have law read at head of their companies twice every year (Digest 1798–1823, p. 368); and law prohibiting Sunday hunting (Clay's Digest, p. 592).

Tennessee.—Law prohibiting Sunday hunting (previous law in 1741).

New York.—Law prohibiting setting traps or sticks or spears for deer, or watching for deer at night within 30 rods of a highway (chap. 97).

1805. Ohio.—Law prohibiting hunting on Sunday (chap. 43).

1807. Indiana.—Law prohibiting Sunday hunting (chap. 37).

1808. Georgia.—Decision in State *v.* Campbell (1 T. U. P. Charlton, 166) holding that the "Black Act," protecting game parks of England (9 Geo. I, c. 22, 1722) did not become part of common law of Georgia.

1809. New Hampshire.—Law authorizing towns of Newmarket, Stratham, and Exeter to appoint 3 fish wardens—one of the first authorizations for wardens (Act June 27).

Tennessee.—Repeal of game laws of 1729, 1738, 1745, 1766 (chap. 94).

1812. Vermont.—Act protecting muskrats between May 25 and Mar. 15 (chap. 105).

1813. New Jersey.—Incorporation of the fowling and fishing association of Upper Township, Cape May County, the first incorporated association of the kind in the State (Act Feb. 5).

1816. New Hampshire.—Law prohibiting killing between Jan. 10 and Sept. 1 any deer except tame deer or deer kept in private parks (chap. 14).

1817. Indiana.—Second law prohibiting hunting on Sunday by persons 14 years of age or over (chap. 57).

1818. Massachusetts.—Law protecting partridge and quail from Mar. 1 to Sept. 1, and woodcock, snipe, lark, and robin from Mar. 1 to July 4 (chap. 103).

1819. Virginia.—Law granting privilege of hunting to owners of shores on Atlantic Ocean, Chesapeake Bay, and rivers and creeks thereof (chap. 28).

1820. New Jersey.—First protection for game birds and rabbits—woodcock from Feb. 1 to June 25; moorfowl, grouse, partridge, quail, and rabbit from Feb. 1 to Sept. 1 (p. 673).

New York.—Overseers of the poor in towns required to sue for penalties under the deer law (chap. 37).

1821. Illinois.—Law prohibiting Sunday hunting (p. 48).

Massachusetts.—Law prohibiting shooting on salt marshes (except by landowners) between Mar. 1 and Sept. 1 (chap. 10).

New Hampshire.—Law protecting beaver, mink, muskrat, and otter, May 30 to Nov. 1 (chap. 50).

1822. Alabama.—Act to suppress fire hunting by increasing penalty to $50 (in effect Jan. 1, 1823—p. 57). See 1803.

1827. New Jersey.—First decision of supreme court of State on the game law (Chew *v.* Thompson, 9 N. J. Law, 249) involving construction of Act of Dec. 21, 1771, prohibiting trespass with guns.

1828. Florida.—Law prohibiting fire hunting west of Suwanee River; captains of militia to have act read at head of their companies twice every year (approved Jan. 1, 1828, 1827–28, p. 24); general prohibition of fire lighting (approved Nov. 22, p. 48, sec. 106); slaves prohibited from fire hunting or using firearms for killing game without weekly license from master or overseer (p. 174).

1829. Vermont.—Act repealing muskrat law of 1812 (No. 19). This repeal was itself repealed in 1830.

1830. **Maine.**—First game law, protecting moose and deer from Jan. 1 to Sept. 1 (chap. 471).

Virginia.—Deer law changed by closing month of August; close season, Jan. 1 to Sept. 1 (chap. 46).

Ohio.—Law protecting muskrats from May 1 to Oct. 15 (p. 9).

1831. **Massachusetts.**—Law protecting heath hen from Mar. 1 to Sept. 1 (chap. 69).

1832. **Indian Territory.**—First Federal game law, and the oldest one on the statute books, as it remained in force until the admission of Oklahoma in 1907. This law prohibited capture of game by any persons other than Indians, except for subsistence in the Indian country (R. S., sec. 2137).

Virginia.—First law protecting wild fowl, by prohibiting night shooting on water or use of big guns for killing wild fowl for sale (chap. 80).

1833. **Connecticut.**—Towns authorized to make by-laws for regulating capture of birds (chap. 30).

Virginia.—Act amending Act of 1832 by exempting residents shooting wild fowl for their own use from penalties, requiring warrants for seizure of big guns and destruction of such guns (chap. 85).

1834. **Virginia.**—Law further amending Act of 1832 by exempting residents from provision requiring warrants for seizure of big guns (chap. 76).

1835. **Massachusetts.**—Law protecting plover, curlew, dough bird, or chicken bird from Apr. 20 to Sept. 1 at night only (chap. 136).

1836. **Massachusetts.**—Prohibition of sale of marsh birds during close season.

1837. **Massachusetts.**—Close season on heath hen for 4 years (chap. 170).

New Jersey.—Law authorizing landowners to arrest nonresidents hunting on their lands and take them before a magistrate (p. 460).

New York.—Prohibition of purchase or sale of quail, partridge, or woodcock in close season in counties of New York, Kings, Queens, and Westchester (chap. 288).

1838. **New Jersey.**—Law extending close seasons for woodcock to July 5 (from Jan. 1 to July 5) and for partridge, moorfowl, grouse, quail, and rabbit to Nov. 1 (from Jan. 10 to Nov. 1) (p. 216).

1839. **Delaware.**—Law prohibiting nonresidents from killing or capturing wildfowl on the waters or marshes of Delaware Bay or Delaware River (chap. 216).

New York.—"In 1838 [1839, chap. 173] a law was passed in this State, prohibiting the use of batteries. For a short time it was respected—but the gunners . . . defied it; at first shooting with masks, at the same time threatening to shoot the informer, should one be found. They finally laid aside their masks, and the law became a dead letter, and has since been repealed." [Laws 1840, chap. 77.] (Giraud, Birds of Long Island, p. 295, 1844.)

Virginia.—Law prohibiting use of skiffs in hunting wildfowl at any time in Accomac and Fairfax Counties except by owners of marshes hunting thereon (chap. 80).

1840. **Pennsylvania.**—Noncitizens of State prohibited from hunting deer in Monroe, Pike, or Wayne Counties (No. 117, sec. 6).

1841. **Delaware.**—Law of 1839 extended to include all rivers, creeks, and lands bordering thereon in the State (chap. 303).

Maine.—Decision in case of Peables *v.* Hannaford (18 Me., 106) construing definition of open seasons.

Pennsylvania.—Provision prohibiting killing of squirrels, Jan. 1 to June 10, in certain townships of Chester, York, Lehigh, Delaware, and Montgomery Counties (Act No. 27, sec. 2).

Virginia.—Act prohibiting nonresidents from killing wildfowl in any counties below the head of tidewater (chap. 79).

1842. **Virginia.**—Amendment to Act of 1841, authorizing officers to seize boats, tackle, ammunition, and arms used in illegally hunting wildfowl (chap. 109).

1844. New York.—Law making close season on deer Dec. 1 to Oct. 1, holding owner of dog killing deer in close season guilty of violating the act, and providing that any person chasing deer in close season shall be deemed in possession thereof (chap. 109).

Organization of New York Association for the Protection of Game, oldest game protective association in existence in the United States (Forest and Stream, XXXIII, p. 450, Dec. 26, 1889).

Last record of the occurrence of the wild turkey in New York in Sullivan, Rockland, Orange, Allegany, and Cattaraugus Counties (Eaton, Birds N. Y., p. 380, 1910).

1845 (about). New York.—Killing of last elk in State in Genesee Valley. Antlers now in possession of Maj. W. A. Wadsworth, Geneseo, N. Y. (Grant, Rept. For., Fish, and Game Comm., 1902-3, p. 322, pl.).

1846. Alabama.—Act to prevent camp hunting in Covington County (No. 257).

New Jersey.—General revision of the game laws (Stat. 1847, chap. 3).

Rhode Island.—First law protecting game birds and prohibiting spring shooting; close season on lark, robin, wood duck, and black duck, Feb. 1 to Sept. 1; partridge, quail, woodcock, and snipe, Feb. 1 to Oct. 1; grass plover, Feb. 1 to Aug. 1; heath hen, Jan. 1 to Nov. 1; unlawful to hunt on lands of another Feb. 1 to Sept. 1 without his permission (p. 15).

1847. Delaware.—First close season for upland game in Newcastle County only. Rabbit, quail, and pheasant, Jan. 1 to Oct. 15, and woodcock, Jan. 1 to Aug. 1 (chap. 128).

1848. Massachusetts.—Law protecting wild pigeon netters by imposing fine of $10 and damages for frightening pigeons from nets (chap. 85).

1849. Massachusetts.—Close season for plover, curlew, dough bird, or chicken bird, Apr. 20 to July 1 (chap. 246).

Minnesota.—Sunday hunting prohibited (chap. 9).

New York.—Act (in effect Jan. 1, 1850) authorizing county boards of supervisors to make ordinances for protection of fish and game (see 1857 and 1859).

Pennsylvania.—Local act prohibiting hunting deer with dogs in Jefferson County under penalty of $20, one-half to informer and one-half to common-school fund of township (No. 403).

1850. Connecticut.—Law protecting insectivorous birds (chap. 5).

New Jersey.—"Act to prevent the destruction of small and harmless birds," including the "small owl" (p. 236).

First attempt to introduce the English sparrow. Eight pairs were imported by Nicholas Pike and others, kept at Brooklyn Institute, New York, over winter and liberated in the spring of 1851, but did not thrive. See 1852 (Bull. No. 1, Biol. Surv., p. 17, 1889).

1851. Alabama.—Decision in Underwood *v.* State (19 Ala., 532) based on the camp hunting act of 1846—the first decision on camp hunting and one of the first decisions of a supreme court on the game laws.

Delaware.—First general game law on birds and rabbits, protecting partridge, pheasant, robin, and rabbit, Mar. 1 to July 1; and prohibiting noncitizens from hunting on lands of another without permission or fowling for export (chap. 569).

Florida.—Two acts regulating camp hunting in Escambia and Santa Rosa Counties (chaps. 416, 417).

Missouri.—First game law, applicable to St. Louis County only, protecting deer, Jan. 1 to Aug. 1; pheasant and quail, Mar. 1 to Sept. 10; woodcock, Feb. 1 to July 4; prairie chicken and grouse, Jan. 15 to Aug. 10; wild turkey, Feb. 1 to Sept. 1 (p. 544).

1851. **Vermont.**—First law protecting nongame birds throughout the year and prohibiting the destruction of their nests or eggs under penalty of $1 for each offense (No. 30).

Wisconsin.—First game laws prohibiting killing of deer, Feb. 1 to July 1 (chap. 171), and prairie chicken, quail, woodcock, and pheasant, Feb. 1 to Aug. 1 (chap. 380).

1852. **California.**—First game law (applicable to 12 counties), protecting quail, mallard duck, and wood duck, Mar. 1 to Sept. 20; deer, elk, and antelope, Jan. 1 to June 1 (chap. 61).

Maine.—Establishment of office of county moose warden and prohibiting aliens from hunting moose or deer (chap. 294).

New Jersey.—Provision prohibiting hunting waterfowl from boat or other floating device placed more than three rods from shore, bank, or ice line (chap. 18).

First successful attempt to introduce the English sparrow. A fund of $200 was raised, about 100 birds were imported from England by a committee of the Brooklyn Institute, New York; 50 were liberated at the Narrows and the others in Greenwood Cemetery in the spring of 1853 (Bull. No. 1, Biol. Surv., p. 17, 1889).

1853. **California.**—Law shortening the close seasons, quail, mallard duck, and wood duck, Mar. 20 to Sept. 1; deer, elk, and antelope, Mar. 1 to July 1 (chap. 137).

Illinois.—First game law (applicable to 15 counties), protecting deer, prairie chicken, quail, woodcock, and wood partridge, Jan. 1 to July 20 (p. 212).

New Jersey.—Close season on deer for 5 years in Bergen, Ocean, and Atlantic Counties (chap. 96).

1854. **Alabama.**—First law protecting snipe, summer duck, and poult deaux in Baldwin, Washington, and Mobile Counties (No. 317). Provision prohibiting killing wild turkeys or catching them in pens, traps, or snares in close season in same counties (No. 62, sec. 4).

North Carolina.—Law prohibiting nonresidents from hunting wildfowl in waters of Currituck County (chap. 55).

Wisconsin.—Law shortening season 2 weeks (Jan. 1 to July 15) and prohibiting trapping of quail, grouse, or prairie chicken except on owner's premises.

1855. **Arkansas.**—Law prohibiting Sunday hunting (p. 180).

Iowa.—Sunday hunting prohibited (chap. 33).

Maryland.—Decision in case of Smith *v.* Maryland (18 How., 71).

Massachusetts.—Law protecting robins, thrushes, linnets, sparrows, bluebirds, bobolinks, yellowbirds, woodpeckers, and warblers throughout the year, and prohibiting purchase, sale, or possession of such birds whether taken or killed "in this Commonwealth or elsewhere" (chap. 197).

1856. **Alabama.**—Law prohibiting hunting or trapping wild hogs in 15 counties without first giving notice to 3 householders nearest place of hunt (No. 203).

Mississippi.—Act giving county boards of police power to pass ordinances regulating times, places, circumstances, and quantities in which oysters and game may be taken or made marketable; sheriffs, constables, town and city marshals authorized to seize with or without process any person who they see or have good reason to believe is violating the regulations (chap. 95).

Virginia.—Law prohibiting killing or running deer with dogs, Jan. 15 to July 15 (chap. 123).

1857. **Indiana.**—First game law protecting deer, Jan. 1 to Aug. 1; wild turkey, Mar. 1 to Sept. 1; pheasant and quail, Jan. 1 to Oct. 1; and prairie chicken, Jan. 1 to Aug. 1; deer in parks and domesticated wild fowl excepted (chap. 31).

Iowa.—First game law protecting deer, elk, wild turkey, prairie chicken, grouse, and quail, Feb. 1 to July 15 (chap. 164).

1857. **Louisiana.**—First game law prohibiting shooting wild ducks, snipe, or water hens on any prairie, lake, lagoon, or bayou belonging to the State in the Parish of St. Bernard (No. 100).

New York.—General law protecting deer, Jan. 1 to Aug. 1 (chap. 287).

Ohio.—First game law protecting deer, rabbit, dove, flicker, wild turkey, quail, ruffed grouse, prairie chicken, and woodcock, Feb. 1 to Sept. 15; wild duck and goose, May 1 to Sept. 15; and certain nongame birds throughout the year (p. 107).

Washington.—Successful introduction of the California Valley quail (*Lophortyx californica californica*) near Olympia. Two lots of birds were imported by Gov. Charles H. Mason and H. A. Goldsborough from San Francisco, Cal., and liberated in the spring. The Goldsborough flock comprised 5 males and 4 females, and by the following winter had increased to nearly 100 birds. (Suckley, Pac. R. R. Repts., XII, pt. II, p. 226, 1860.)

1858. **Illinois.**—1858 or 1859, establishment of deer park of 40 acres near Ottawa by Judge J. D. Caton; 80 acres added in 1861 and 80 in 1867, making a total of 200.

Maine.—First protection for birds—lark, robin, partridge, woodpecker, and sparrow, Mar. 1 to July 1 (chap. 11).

Minnesota.—First game law, protecting deer and elk, Feb. 1 to Sept. 1; grouse, prairie chicken, partridge, and quail, Feb. 15 to July 15 (chap. 19).

1859. **Delaware.**—Law protecting rail and reedbird, July 1 to Sept. 5; publication required in 3 State newspapers 4 weeks before opening of season (chap. 531).

Florida.—Law prohibiting hunting on Sunday (chap. 1007).

Georgia.—Close season for deer in Screven County, Dec. 19, 1859, to Sept. 1, 1862 (Act December 19).

Michigan.—First game law, protecting deer, Jan. 1 to Aug. 1; turkey, Feb. 1 to Sept. 1; woodcock, Mar. 1 to July 14 (?); ruffed grouse, Feb. 1 to Oct. 1; prairie chicken, mallard, and teal, Feb. 1 to Oct. 15; quail, Jan. 1 to Sept. 1 (No. 176).

New York.—First general law for game birds after local act of 1849. Repealed all inconsistent acts (chap. 511).

New Jersey.—Act prohibiting shooting ducks, geese, or brant at night on Barnegat Bay or Manasquan River (chap. 222).

Pennsylvania.—Close season for rail and reedbird, June 1 to Sept. 1 (No. 634).

1860. **Nebraska.**—First game law, protecting deer, elk, prairie chicken, grouse, woodcock, Mar. 1 to July 15; wild turkey and quail, Feb. 1 to Sept. 1 (p. 49).

New York.—Provision protecting wood, black, and teal duck, Feb. 1 to Aug. 1, thereby prohibiting spring shooting (chaps. 186, 384).

Rhode Island.—Act prohibiting use of ferrets or weasels in hunting hares or rabbits (chap. 334).

Texas.—First game law (local), protecting quail on Galveston Island for 2 years and thereafter Mar. 1 to Sept. 1 (chap. 72).

1861. **Kansas.**—First game law (applicable only to Leavenworth County except eastern township), protecting quail, partridge, and prairie chicken, Apr. 1 to Nov. 1 (chap. 18); first general law, protecting deer, quail, prairie chicken, partridge, and wild turkey, Apr. 1 to Sept. 1. On petition of 20 freeholders of the county, county commissioners may proclaim the act inoperative in such county for 1 year (chap. 39).

Kentucky.—First game laws: (1) local law protecting bluebird, swallow, "marten," robin, wren, "or other bird smaller than a quail," except hawk, snipe, or plover, in Campbell, Kenton, Pendleton, and Mason Counties (chap. 36, app. Sept. 20); (2) general law prohibiting killing above-mentioned birds and also sparrow, mockingbird, thrush, redbird, and screech owl on public highway or lands of another; providing close seasons for quail, partridge, pheasant, meadowlark, woodcock, snipe, plover, Apr. 1 to Sept. 1; goose and duck, May 1 to Sept. 15; excepting birds of prey and others damaging crops, protecting nests and eggs and protecting female deer, Mar. 1 to Aug. 1 (chap. 309, app. Dec. 21).

1861. Nevada.—First game law, protecting deer, elk, antelope, mountain sheep, and mountain goat, Jan. 1 to July 1; grouse, sage hen, prairie chicken, partridge, pheasant, woodcock, wild duck, goose, brant, swan, sandhill crane, plover, snipe, curlew, robin, dove, lark, yellow hammer, and bittern, Apr. 1 to Sept. 1; and certain nongame birds at any time (chap. 14).

New York.—Killing of last moose in the Adirondacks, a cow on the South Inlet of Raquette Lake in July, a young bull on Marion River in August, and a cow in the autumn on East Inlet of Raquette Lake. (Madison Grant, 7th Rept. For. Fish. and Game Comm., p. 235, 1902.)

1862. New York.—First law prohibiting sale of quail, ruffed grouse, and woodcock in close season throughout the State (sec. 8); close season of 5 years for deer on Long Island; fawn in spotted coat protected throughout State; killing wild pigeons on nesting ground, breaking up nests, or shooting within 1 mile of nesting grounds prohibited (sec. 5); protection of nongame birds, including eagle and fish hawk, with exception in favor of persons collecting for scientific purposes (sec. 6); pinnated grouse protected for 10 years; unlawful to trespass on lands surrounding a dwelling house to shoot (sec. 20, chap. 474).

1863. Maine.—Close seasons for quail, Mar. 1 to Sept. 1, and woodcock, Mar. 1 to July 4; purchase or sale of native or imported birds prohibited in close season (chap. 166).

1864. Idaho.—First game law, protecting buffalo, deer, elk, antelope, mountain sheep, and mountain goat during a uniform season, Feb. 1 to July 1 (p. 598).

Minnesota.—Provision making it unlawful to enter upon growing crops with gun or dog without permission of the owner (chap. 60).

New York.—First license law in the United States, a local law for Suffolk County, to go into effect in 1867. This law required $10 permits issued by justice of the peace to shoot deer. (Never actually in force.) (Chap. 426.)

1865. Connecticut.—Law prohibiting use of ferrets in hunting rabbits (chap. 16).

Michigan.—Law prohibiting use of punt or swivel guns and providing first protection for "any small bird not known as a game bird," except blackbirds (No. 278).

New York.—Organization of State Fish, Game, and Forest League.

Washington.—First game law, prohibiting wanton destruction of game and killing deer or elk for sale, Feb. 1 to July 1; pheasants, partridges, or grouse, Apr. 1 to Aug. 1, except Snohomish and Kitsap Counties, and Indians hunting on reservations (p. 37).

Publication of "Digest of Bird and Game Laws" of 19 states, by J. R. Dodge (Rept. Dept. Agriculture for 1864, pp. 442–446).

1866. Florida.—Hunting permission law, prohibiting hunting on inclosed lands of another without permission (chap. 1466, sec. 19).

New Jersey.—Close term on prairie fowl for 5 years.

Pennsylvania.—Provision protecting all squirrels, Jan. 1 to Aug. 15, in Chester and 10 other counties (Act Apr. 11, sec. 2).

1867. Colorado.—First game law, protecting elk, deer, antelope, mountain sheep, and wild turkey during a uniform season, Jan. 15 to Aug. 15, and establishing a close season for 2 years on pheasant, quail, and prairie chicken (p. 68).

Indiana.—Provisions prohibiting netting of quail and prairie chicken at any time (chap. 58, secs. 2 and 3).

1867. New York.—Act to consolidate the acts relating to game—protecting fawns (sec. 2); prohibiting discharge of firearms within a quarter of a mile of nesting grounds or destruction of nests of wild pigeons (sec. 3); protecting eagle and fishhawk (sec. 6); protecting pinnated grouse for 10 years (sec. 7); permitting possession of quail, ruffed grouse, etc., for keeping alive through the winter (sec. 8); and providing fine of $10 for entering to shoot on any grounds surrounding a dwelling house (chap. 898); law providing that proof of killing game outside the State is a valid defense for possession or sale in close season.

Wisconsin.—Provision requiring game law to be published during the first week in April each year in some newspaper at the county seat of each county and making it the duty of county treasurer to cause such publication to be made (chap. 78, sec. 8).

1868. New York.—Last great pigeon nesting in New York. "Millions of birds occupied the timber along Bells run [in a tract about 14 miles long], near Ceres, Allegany County, on the Pennsylvania line." (Eaton, Birds New York, p. 382, 1910.)

West Virginia.—First game law, protecting deer Jan. 15 to July 15, and prohibiting running deer with dogs unless deer be wounded (chap. 186). (See Virginia, 1856.)

Publication of Fur, Fin, and Feather, by Charles Suydam, the first complete compilation of the game laws of the United States and Canada.

1869. Michigan.—Uniform open season for all game, Sept. 1 to Jan. 1. (No. 124). Prohibition of use of firearms to destroy wild pigeons within half a mile of nesting or roosting grounds (No. 124, sec. 9).

Minnesota.—"Act to prohibit the setting of trap or spring guns" (chap. 39).

New Jersey.—Close term for 3 years on ruffed grouse (chap. 422).

New York.—Hunting deer with dogs prohibited, close season on deer and moose for 5 years in Kings, Queens, and Suffolk Counties (sec. 1); swivel or punt guns prohibited[1] (sec. 4); duty of sheriffs, constables, and other police officers to enforce the act (sec. 5); prairie fowl protected 10 years (sec. 7); sailing for wildfowl or shooting them from any vessel propelled by sail or steam prohibited in Kings, Queens, and Suffolk Counties (sec. 12); prohibiting hunting on posted lands and providing regulations for posting (secs. 13 and 14); exemption in favor of persons proving that game in possession in close season was imported from abroad, killed in open season, or killed outside the State; quail, grouse, prairie chicken, and venison after Mar. 1 excepted (sec. 25). (Chap. 909.)

North Carolina.—Act prohibiting fire hunting waterfowl in Carteret, Craven, Hyde, Currituck, Tyrrell, and Onslow Counties.

Pennsylvania.—Provision prohibiting baiting, building blinds, trapping, or snaring wild turkey, ruffed grouse, quail, or woodcock, but permitting trapping of quail Nov. 15 to Jan. 1 "for the sole purpose of preserving them alive over the winter" (Act No. 60, sec. 8).

West Virginia.—"Act to prevent the destruction of small game," prohibiting the killing of pheasants, ducks, partridges, or rabbits from Feb. 14 to Sept. 15, making it unlawful to "kill or destroy any other birds except crows, ravens, eagles, hawks, owls, jaybirds, woodpecker, and blackbirds," or to catch rabbits with ferrets or snares at any season (chap. 96). The first law in the United States covering all nongame birds.

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[1] Use of big guns prohibited in 1866 (chap. 813, sec. 1).

1869. **Wyoming.**—First game law, prohibiting offering for sale elk, deer, antelope, and mountain sheep, Feb. 1 to Aug. 15; pheasant, quail, prairie chicken, and sage hen, Feb. 1 to Aug. 15 (chap. 12).

1870. **Maine.**—Close season for deer, moose, and caribou Feb. 1 to Oct. 1, first protection for caribou (chap. 134). Protection of nongame birds, larks, robins, swallows, and sparrows; and also partridges, grouse, quail, woodcock, and snipe, Feb. 1 to Sept. 1 (chap. 165—compare 1863).

Massachusetts.—First law prohibiting spring shooting of rail, snipe, plover, or shorebirds, Apr. 1 to July 15; and wood duck, black duck, and teal, Mar. 1 to Sept. 1; providing open season for wild pigeons in September, October, and November; protecting deer for 2 years, heath hen for 6 years; providing for permits for collecting birds for scientific purposes (chap. 304).

Montana.—First game law, protecting grouse, prairie chicken, pheasant, and fool hen, Mar. 1 to Aug. 15, and making a close season for three years for partridge and quail (1869–70, p. 65).

North Carolina.—Law prohibiting use of any gun other than one fired from the shoulder on the waters of Currituck County, or use of any blinds or batteries in the water away from the marshes or shores. (Chap. 42. Ratified Feb. 14.) Repealed Dec., 1870.

Pennsylvania.—Three-year close season for quail in Berks County (No. 407).

Tennessee.—Constitutional provision authorizing local game legislation for "particular counties or geographical districts designated by the General Assembly" (Art. XI, sec. 13).

1871. First bill introduced in Congress to protect buffalo.

Alabama.—Uniform open season for all game, Sept. 1 to Mar. 1 in Mobile County (Acts 1871–72, No. 168).

Massachusetts.—Repeal of anti-spring-shooting provisions on shorebirds (see 1870).

Minnesota.—General game law containing provisions prohibiting export of game for sale or traffic (sec. 12) and for publishing the game law annually during the first week in April in some newspaper at the county seat of each county (chap. 33).

Mississippi.—Provision granting boards of county supervisors power to regulate protection of game (Code, chap. 30, sec. 1889).

New York.—Codification of the game laws 1859–71. (Sec. 22 authorized county boards of supervisors to pass ordinances for the protection of birds, fish, or game other than those mentioned in the act.) Compare 1849.

Creation of the office of game constable. Election held in each town for officer to serve for one year, compensation fees of constable and half the fines (chap. 721).

Ohio.—Organization of the State Society for the Protection of Game and Fish (afterwards Cuvier Club, see 1874).

Pennsylvania.—Incorporation of the Blooming Grove Park Association (p. 441) and establishment of its game preserve.

Utah.—Introduction of bobwhite quail in Great Salt Lake Valley (Allen in Bendire's Hist. N. Am. Birds, II, p. 2, 1892).

Wyoming.—Law prohibiting waste of game (p. 113).

1872. **Congress.**—Introduction of the Cole resolution in the Senate "that the Committee on Territories be directed to inquire into the expediency of enacting a law for the protection of the buffalo, elk, antelope, and other animals."

Establishment of the Yellowstone National Park, Wyoming (17 Stat., 32).

Colorado.—Law prohibiting waste of game (p. 134, sec. 6).

1872. **Maryland.**—Law for protection of wildfowl on the Susquehanna Flats—open season Nov. 1 to Mar. 31; shooting days, Mondays, Wednesdays, and Fridays from one hour before sunrise to half an hour after sunset; night shooting, big guns, or shooting from boats within half mile of shore prohibited; licenses required for sink boxes and sneak boats, etc.; board of ducking police from Cecil and Harford Counties provided (chap. 54).

Law permitting citizens of Dorchester County to extend to their guests the privileges of shooting wildfowl on Choptank River on Tuesdays, Thursdays, and Saturdays (chap. 442).

Nebraska.—Constitutional provision prohibiting the enactment of local laws for the protection of game and fish (sec. 542).

Oregon.—First game law, protecting deer, elk, and moose, Feb. 1 to July 1; swan, mallard, wood duck, widgeon, sprig, teal, spoonbill, and black duck, Apr. 1 to Aug. 1; grouse, pheasant, and sage hen, Apr. 1 to June 15; prairie chicken, Mar. 1 to July 1; quail, Apr. 1 to July 1; and permitting farmers to kill ducks and geese if necessary to protect crops (p. 25).

South Carolina.—Provision protecting insectivorous birds and turkey buzzard (No. 121, sec. 5).

Utah.—First game laws, protecting quail and imported birds for five years (chap. 11); close season for deer, elk, antelope, and mountain sheep, Jan. 1 to Sept. 1 (chap. 24).

1873. **Indiana.**—First law protecting nongame birds (chap. 55, sec. 2).

New Hampshire.—Decision of the supreme court in Aldrich *v.* Wright (53 N. H., 398).

New Jersey.—Incorporation of the West Jersey Protective Association and the requirement of nonresident licenses for hunting in Atlantic, Camden, Cape May, Cumberland, Gloucester, and Salem Counties (chap. 470).

New York.—Publication of the game laws in pamphlet form—apparently the first publication of the kind.

Establishment of Forest and Stream and first publication of a comparative table of close seasons for game.

1874. **Congress.**—Passage of a bill to prevent useless slaughter of buffalo within the Territories of the United States. (The bill failed to receive the signature of President Grant before adjournment.)

Iowa.—Restriction on the shipment of game birds (12 per day if not for sale—chap. 69).

Massachusetts.—Organization of fish and game protective association.

New Jersey.—Revision and codification of the game law; act of 32 sections, including first close season on gray squirrel, Jan. 1 to July 1, and close terms for six years on wild turkey and prairie chicken (chap. 524).

"Act to incorporate the Central Association for the propagation and protection of game" in Somerset, Mercer, and Middlesex Counties, conferring on members all powers of constables and authorizing all members to arrest without process violators of the game laws (chap. 211).

Ohio.—Organization of the Cuvier Club, formerly the Ohio State Society for the Protection of Game and Fish. (See 1871.)

Oregon.—Law protecting deer, moose, elk, antelope, and mountain sheep, Feb. 1 to Sept. 1; changing seasons for grouse, prairie chicken, sage hen, and quail, and prohibiting killing deer or elk solely for hides, horns, or hams (p. 6).

Rhode Island.—Provision requiring town and city councils to appoint a special constable annually to enforce the game law (chap. 391, secs. 7–8).

Establishment of Field and Stream, later changed to the Field, the Chicago Field, and still later the American Field.

1875. **Arkansas.**—First game laws, imposing a $10 tax on nonresident trappers, hunters, and fishermen (p. 150, and adj. sess., p. 176).

Florida.—First nonresident license law, requiring a fee of $25 for hunting in each county (chap. 2055).

Idaho.—Introduction of bobwhite quail. A few pair were turned out near Boise City and by 1878 had become abundant between that point and Snake River. By 1882 they had spread to the west side of Snake River, 50 miles from where they were first liberated (Bendire's Life Hist. N. Am. Birds, I, p. 2, 1892).

New York.—Decision in case of Phelps *v.* Racey (60 N. Y., 10), maintaining the right of the State to legislate concerning imported game.

Last great pigeon roost in New York at Coopers, Steuben County (Forest and Stream, IV, p. 204, 1875).

North Dakota.—First game law, protecting quail, prairie chicken, and grouse, Mar. 1 to Aug. 1 (chap. 49).

South Dakota.—First game law (same as North Dakota).

West Virginia.—Provisions prohibiting shooting on land of another within gunshot of an occupied dwelling, and shooting ducks, geese, and brant, Feb. 1 to Sept. 1 (chap. 117).

1876. **Kansas.**—General law containing first protection of California quail and nongame birds, including turkey buzzard, lark, swallow, kingbird, and "other upland insectivorous birds," their nests and eggs (sec. 3); and prohibiting shipment (sec. 6) of protected animals or birds out of State (chap. 82). The export provision was declared unconstitutional the following year (see State *v.* Saunders, 1877).

Missouri.—Decision in case of State *v.* Randolph (1 Mo. App., 15) involving the sale of imported game (the second decision of the kind).

1877. **Florida.**—Plume-bird law prohibiting wanton destruction of nests, eggs, and young of sea birds and birds of plume (chap. 3043).

Illinois.—"Act declaring certain animals and birds Ferae Naturae, to be personal property" [when raised in domestication or kept in inclosures and reduced to possession] (p. 6).

Kansas.—Decision in case of State *v.* Saunders (19 Kans., 127), export. Compare Phelps *v.* Racey, New York, 1875.

Missouri.—Law prohibiting nonresidents from hunting game for sale or export (p. 333).

Virginia.—Decision of the Supreme Court of the United States in McCready *v.* Virginia (94 U. S., 395).

1878. **California.**—Jurisdiction of boards of fish commissioners extended to game.

District of Columbia.—First general game law, prohibiting killing, possession, or exposure for sale of quail, Feb. 1 to Nov. 1; ruffed grouse, Feb. 1 to Aug. 1; woodcock, Feb. 1 to July 1; prairie chicken, Feb. 1 to Sept. 1; snipe or plover, May 1 to Sept. 1; duck, goose, or brant, Apr. 1 to Sept. 1; rail or ortolan, Feb. 1 to Sept. 1; venison, Jan. 1 to Aug. 15; protecting the turkey buzzard and insectivorous birds throughout the year; prohibiting robbing of nests, trapping, or trespassing; provision for posting lands (20 Stat., 134).

Iowa.—First bag-limit law in the United States (25 prairie chickens, snipe, woodcock, quail, and ruffed grouse per day), export prohibited (chap. 156).

Maine.—Close term for moose for two years (chap. 50).

New Hampshire.—Establishment of board of fish and game commissioners.

Pennsylvania.—General revision of the game law, including (sec. 15) provisions prohibiting killing or disturbing wild pigeons on nesting grounds, discharging firearms within quarter of a mile of such grounds, or killing pigeons on their roosting grounds, and requiring a $50 license (issued by the county treasurer) from nonresidents trapping or netting pigeons (Act June 3).

1879. **Delaware.**—Game protective association incorporated and nonresidents prohibited from hunting in the State without securing a certificate of membership (chap. 111).

Idaho.—Provision protecting eagles and their nests and eggs at all times (p. 39, sec. 2).

Indiana.—Protection of woodcock and duck; hounding prohibited; export prohibited (chap. 122).

Michigan.—Act to prevent the killing of elk for 10 years (No. 233).

Missouri.—Nonresidents prohibited from hunting in the State (R. S., sec. 1618).

New Jersey.—"Act to authorize the formation of associations and societies for the more effectual protection of game and game fish" (chap. 87); comprehensive law for wild-fowl shooting on Barnegat Bay, prohibiting shooting between sunset and sunrise, sailing for birds, or shooting from boats propelled by steam or sail, or from any boats or structures anchored in the bay; rest days established for shooting in Mosquito Cove (chap. 109).

Virginia.—"Act to protect buzzards"—turkey buzzards and black buzzards (Acts 1878–79, chap. 72).

Importation of large numbers of European quail. Nearly 3,000 distributed in New England and the Middle States (Forest and Stream, XII, p. 371, 1879).

1880. **Connecticut.**—Act establishing rest days on Tuesdays and Fridays between Oct. 20 and Apr. 20 for shooting on certain parts of the Housatonic River (chap. 88).

Maine.—Jurisdiction of commissioners of inland fisheries extended to game (chap. 208).

Massachusetts.—Decision in case of Comm. *v.* Hall (128 Mass., 410).

New Mexico.—First game law with uniform close season for all game, deer, elk, buffalo, antelope, sheep, turkey, grouse, and quail, May 1 to Sept. 1 (chap. 25).

Publication of Hallock's Bibliography for Sportsmen (in Sportsmen's Gazetteer).

1881. **Arizona.**—Establishment of board of three fish commissioners (No. 66).

Illinois.—Decision in case of Magner *v.* People (97 Ill., 320), involving the right of the State to legislate concerning imported game. First decision of the kind in the State and the first enunciation of the principle that the game belongs to the State.

Oregon.—First importation of ring-necked pheasants, 12 males and 3 females, liberated 12 miles below Portland.

1882. **Massachusetts.**—"Act for the better protection of deer," making it unlawful to hunt deer except on Tuesdays, Wednesdays, Thursdays, and Fridays in November (chap. 199).

Oregon.—Close season on ring-necked pheasant for 5 years (p. 61).

Wyoming.—Uniform open season for all big game in month of October and prohibition of killing more than can be used for food (chap. 49).

1883. **California.**—Law protecting at all times elk, antelope, mountain sheep, female deer, and spotted fawn, prohibiting possession, sale, or transportation of deer from which evidence of sex has been removed, and prohibiting hunting of animals unless carcass is used by hunter or sold for food (chap. 43).

Connecticut.—Appointment by selectmen of each town of two or more game wardens for two years, at same compensation as that of grand jurors (chap. 133).

1883. **Georgia.**—Act to prevent the discharge of firearms on public highways, or within 50 yards thereof, between dark and daylight (No. 378).

Maine.—First limit law on big game, 1 moose, 2 caribou, 3 deer a season (chap. 185).

Pennsylvania.—Act prohibiting killing web-footed wildfowl except on Mondays, Wednesdays, and Fridays, Sept. 1 to Jan. 1 (Act May 17). Repealed 1885. Act removing protection from the English sparrow (Act June 4).

1884. Appointment of the American Ornithologists' Union committee on protection of North American birds (Auk, I, p. 376, 1884; Bird-Lore, VII, p. 46, 1905).

1885. **Delaware.**—First protection for waterfowl and first close terms for ruffed grouse and jack rabbit (chap. 507).

New Jersey.—Prohibiting killing, possession, or exposing for sale of certain nongame birds, including snowbird, tern, gull, "or any insectivorous or song bird, not generally known as a game bird" (sec. 1), or killing, buying, or selling said birds, "or any heron, crane, fish hawk, kingfisher, yellowhammer or blue jay," for the purpose of preserving or stuffing the same as an article of ornament or apparel (sec. 3); excepting the English sparrow from protection (chap. 207).

1886. **Congress.**—Provision forbidding legislatures of the Territories to pass local laws for the protection of game or fish (24 Stat., 170).

Kansas.—Law prohibiting hunting on traveled or public roads; and sale of protected birds except by hunter to direct consumer (chap. 110).

Massachusetts.—Jurisdiction of commissioners of fisheries extended to game.

New Jersey.—Decision in the case of Allen *v.* Wyckoff (48 N. J. L., 90) sustaining the nonresident license law.

New York.—Enactment of the first limit law in the State, 3 deer a season, prohibiting hounding in Delaware and St. Lawrence Counties at any time, and in rest of State except Sept. 1 to Oct. 5, and prohibiting crusting or killing deer while yarded (chap. 194), and the first A. O. U. "model law" for the protection of nongame birds, with definition of game birds, provision for permits for collecting specimens for scientific purposes, excepting the English sparrow from protection (chap. 427; see also Science, No. 160, Supp., p. 13, Feb. 26, 1886); law prohibiting sailing for wildfowl or shooting them from boats propelled by steam or sails except on Long Island Sound, Lake Ontario, and Hudson River below Iona Island (chap. 112).

Ohio.—Establishment of the board of 5 commissioners of fish and game, term 5 years (p. 186, sec. 1).

Organization of first Audubon Society by Forest and Stream, New York.

Publication of Law of Field Sports by G. P. Smith, containing summaries of State game laws.

1887. **Arizona.**—Jurisdiction of fish commissioners extended to game (Rev. Stat., p. 536); first protection for deer, elk, antelope, goat, sheep, Feb. 1 to Oct. 1; partridge, wild turkey, duck, goose, brant, swan, curlew, plover, snipe, rail, Mar. 1 to Sept. 1 (Rev. Stat., p. 752).

Delaware.—Provision prohibiting hunting when the ground is covered with snow (chap. 100, sec. 3).

Georgia.—Introduction of the English pheasant; 78 liberated on Jekyl Island, near Brunswick, increased to 850 the following year (Forest and Stream, XXXI, p. 221, 1888).

Michigan.—Establishment of fish and game warden department with State warden appointed for 4 years, at a salary of $1,200 per annum (No. 28, approved Mar. 15). Provisions for special deer season on Upper Peninsula; prohibiting killing deer in water, by pits, traps, artificial lights, or use of dogs in hunting (No. 256).

1887. Minnesota.—Creation of the office of [State] game warden without salary, term 4 years (chap. 142, sec. 6, approved Mar. 8); prohibiting hunting in standing grain (chap. 142, sec. 5).

Wisconsin.—Act (chap. 374) making uniform close season for all game birds except woodcock, Dec. 1 to Sept. 1, thus prohibiting spring shooting of shorebirds or waterfowl (sec. 1); prohibiting use of snares, nets, traps, spring guns, swivel guns (sec. 4), sneak boats, sailboats, steam boats, floating boxes or rafts, or blinds in open water outside natural growth of rushes (sec. 6); killing or possession of game with intent of exporting it (sec. 8); "act to prevent the killing of birds for millinery purposes" (chap. 413); and act authorizing the governor to appoint 4 game wardens, term 2 years, salary $600 and expenses not to exceed $250, and authorizing the secretary of state to print 5,000 copies of the fish and game laws (chap. 456, approved Apr. 12).

Organization of the Boone and Crockett Club.

1888. New Jersey.—Division of the State into a northern and a southern section with different seasons (chap. 252).

New York.—Creation of the office of chief game and fish protector, salary $2,000 per annum, term pleasure of board of fish commissioners (chap. 577, sec. 1).

1889. Arkansas.—Provision declaring that all game and fish, except fish in private ponds, found in the State are the property of the State, and that their capture is a privilege (Act. 117, sec. 1).

Minnesota.—Prohibition of the use of firearms by minors under 14 unless accompanied by parent or guardian (chap. 16).

Pennsylvania.—A. O. U. model law for the protection of nongame birds, with definition of game birds and provision for permits for collecting for scientific purposes (No. 228).

Texas.—Killing at Buffalo Springs of the last buffalo in the State and the last of the southern herd (Seton, Scribner's Mag., XL, p. 402, 1906).

First census of buffalo made by Dr. W. T. Hornaday (Ann. Rept. U. S. Nat. Mus. for 1886–87, p. 525, 1889).

1890. Congress.—Establishment of the General Grant, Sequoia (26 Stat., 478), and Yosemite National Parks in California.

Illinois.—Decision in the case of the American Express Co. *v*. The People (24 N. E., 758; 133 Ill., 649).

New Hampshire.—Establishment of the Corbin herd of buffalo in the Blue Mountain Forest Game Preserve, near Newport. (Baynes, 4th Ann. Rept. Am. Bison Soc., p. 42, 1911).

Ohio.—Provision prohibiting use of batteries, or steam or naphtha launches, in hunting waterfowl (Acts 1890, p. 66).

Oklahoma.—First game law, protecting doves and insectivorous birds throughout the year; muskrat, mink, and otter, Apr. 15 to Feb. 15; buffalo, elk, mountain sheep, and antelope, Jan. 1 to Oct. 1; grouse, Jan. 1 to Sept. 1; quail and wild turkey, Jan. 1 to Oct. 1 (Nebr. law 1885, chap. 102). One of the laws of Nebraska in force Nov. 1, 1889, adopted by Act of Congress for Oklahoma.

Vermont.—Incorporation of the Vermont Fish and Game League (No. 147).

Washington.—Creation of the office of game warden, term 4 years, appointed to serve without salary but entitled to half the fines collected (p. 105, sec. 5); act prohibiting the chasing of deer with dogs anywhere in the State (p. 105). Repealed 1897.

Wyoming.—Law (chap. 12) providing a 10-year close season on buffalo (sec. 4); abolishing the open season on deer, elk, moose, mountain sheep, goat, and antelope, but allowing residents to kill for family consumption not more than 3 game animals a week at any time, but not for sale (sec. 3); and providing for the appointment by justices of the peace of special constables to enforce the provisions of the act (sec. 11).

1890. Publication of C. B. Reynolds's "Book of the Game Laws," containing the game laws of the United States and Canada in full.

1891. **Alabama.**—"Act to prevent hunting on land without written consent of owner or his agent" in 9 counties (Acts 1890–91, No. 584).

Colorado.—Jurisdiction of State fish commissioner extended to game (p. 232).

Georgia.—General law providing a close season for deer (Jan. 1 to Sept. 1), and for wild turkey, partridge, and pheasant (May 1 to Sept. 1), but not to modify local laws (No. 683).

Indiana.—A. O. U. "model law" protecting nongame birds, with definition of game birds and provision for collecting for scientific purposes (chap. 87); act prohibiting hunting on lands of another without written permission of owner or occupant, but prosecution to be made only with his consent (chap. 187).

Michigan.—Provision prohibiting training or practicing dogs on game birds during the close season (act 152).

Minnesota.—Board of fish and game commissioners substituted for a game warden (chap. 9).

North Carolina.—Provision for appointment of game keepers in Currituck County, with power to arrest violators of the game law of the county, term 2 years, salary paid from funds placed in hands of county treasurer for the purpose by "those interested in the gaming interest" (chap. 487). Repealed 1895 (chap. 176). Reenacted 1899 (chap. 242).

Pennsylvania.—Decision in the case of Comm. *v.* Wilkinson (21 Atl., 14; 139 Pa., 248), holding that the game laws do not apply to game captured outside the State.

Wisconsin.—Creation of the office of State game warden (chap. 436).

International Fish and Game Conference held in New York October 12, and Detroit December 20–21.

1892. **Vermont.**—Fish commission reorganized as a fish and game commission (No. 80).

1893. **Colorado.**—Provision making it unlawful to use elk, deer, or antelope for baiting traps (chap. 97).

Florida.—First nonexport law, prohibiting shipment of partridges or quail (chap. 4146), and first protection for the manatee (chap. 4208).

Georgia.—General law making act of 1891 uniform throughout the State, prohibiting sale in certain seasons, and protecting insectivorous birds (No. 342).

North Carolina.—Provision prohibiting shooting with rifles on Core Sound, Carteret County, Nov. 1 to Mar. 21 (chap. 266).

Oregon.—Creation of the office of game and fish protector (p. 177).

Wisconsin.—"Act to secure the better protection of game." Section 1 makes the close season for ducks, geese, and brant Dec. 1 to Sept. 1 with the following proviso: "This section shall not be in force, except upon the proclamation of the Governor of this State, who shall issue such proclamation when it shall appear to his satisfaction that the States of Iowa, Minnesota, Michigan, and Illinois have enacted laws substantially in conformity with the provisions of this section" (chap. 106).

1894. **Congress.**—Act protecting game in the Yellowstone National Park (28 Stat., 73).

Provision in Tariff Act prohibiting importation of eggs of game birds (28 Stat., 540).

California.—Decision in the case of Ex parte Maier (37 Pac., 402; 103 Cal., 476), sustaining the right of the State to legislate regarding imported game.

Minnesota.—Decision in case of State *v.* Rodman (59 N. W., 1098; 58 Minn., 393).

New Jersey.—Jurisdiction of the commission of fisheries extended to game (chap. 209).

Ohio.—"Act providing for the dedication of the Licking Reservoir as a public park" and prohibiting killing or disturbing waterfowl, birds, or game therein (p. 380).

1894. **Ohio.**—Decision in the case of Roth *v.* State (37 N. E., 259; 51 Ohio, 209), sustaining the right of the State to legislate regarding imported game.

Adoption by Forest and Stream of plank to prohibit the sale of game (Forest and Stream, XLII, pp. 89, 111, 115, Feb., 1894).

Bird Day proposed by Prof. C. A. Babcock and first observed in public schools of Oil City, Pa., May 4 (Cir. No. 17, Biological Survey, 1896).

1895. **California.**—Millinery provision in game law (chap. 202, sec. 627c).

Connecticut.—Establishment of the commission of fisheries and game (chap. 46).

Illinois.—Introduction of the "Blow bill" (H. B. 56), practically opening the Chicago markets to unlimited sale of game from other States, and containing in section 7 a provision for a $1 resident hunting license required of all persons except owners or occupants of cultivated farms; this bill failed to pass (Am. Field, XLIII, pp. 123, 147, 1895).

Michigan.—Adoption of the first nonresident and resident license system and limit law (No. 117); and first antisale law, prohibiting sale of quail, partridge, and woodcock at any time (No. 223).

Minnesota.—Adoption of the nonresident license system; reciprocal license—$25 fee required of citizens of States which have restrictive laws against nonresident hunters (chap. 207).

Missouri.—Creation of the office of game and fish warden (p. 182). Repealed 1903.

New York.—Forest, fish, and game commission substituted for the commission of fisheries (chap. 395).

Incorporation of the New York Zoological Society.

North Dakota.—Adoption of the resident and nonresident licenses and the creation of the office of State game warden (Rev. Codes, secs. 1642–1646).

Oregon.—Joint memorial to Congress for protection of eggs of wildfowl in Alaska and regulation of traffic in wild-duck eggs (No. 8).

Pennsylvania.—Establishment of the board of three game commissioners (chap. 187).

Wyoming.—Nonresident $20 license adopted and jurisdiction of fish commissioner extended to game (chap. 98).

"Duck Egg Fake."—Alleged wholesale destruction of eggs of wildfowl in Alaska for manufacture of egg albumen, resulting in attempt to secure appropriation of $5,000 by Congress to investigate question. (See Forest and Stream, XLIV, pp. 503–505.)

1896. **California.**—Decision in the case of Kellogg *v.* King (46 Pac., 166; 114 Cal., 378), involving the protection of private preserves by injunction.

Traffic in seabirds' eggs stopped by an order of the Lighthouse Board, issued in December, prohibiting collecting or selling eggs on the Farallon Islands (Auk, XIV, p. 27, 1897; XV, p. 109, 1898).

Louisiana.—Act authorizing police juries to pass ordinances for the protection of game and fish (No. 66).

Maryland.—Creation of the office of game warden (chap. 293).

New Jersey.—Repeal (chap. 67) of act to incorporate the West Jersey Game Protective Society (see 1873).

Decisions of the Supreme Court of the United States in Geer *v.* Connecticut, declaring game the property of the State, and sustaining the right of the State to prohibit export of game (161 U. S., 519), and in Ward *v.* Race Horse, sustaining the right of the State to enforce its game laws on public lands and over Indians (163 U. S., 504).

Revival of the Audubon movement by the organization of societies in Massachusetts and Pennsylvania.

1897. **Congress.**—Introduction of the original Lacey bill in the House on July 1, and the Teller bill in the Senate on July 2, to prohibit illegal export of big game from Colorado, Utah, and Wyoming.

Act preventing trespassing on National Military Parks (29 Stat., 621).

California.—Provision in county-government act authorizing boards of supervisors to shorten open seasons for fish and game (chap. 277, sec. 25, sub. 28).

Colorado.—Destruction of the Lost Park herd of buffalo; the last wild buffalo in the United States outside the Yellowstone National Park. (Am. Field, LXXIII, p. 273, 1910.)

Connecticut.—Provision prohibiting use of sulphur in smoking out rabbits (chap. 109).

District of Columbia.—Organization of Game and Fish Protective Association.

Decision in the case of Javins *v.* U. S. (11 App. D. C., 345), sustaining the law regulating sale of imported game.

Florida.—First warden law, providing for county wardens (chap. 4563).

Georgia.—Close season for opossums, Mar. 1 to Oct. 1 (No. 166).

Illinois.—Decision in the case of Merritt *v.* People (48 N. E., 325).

Iowa.—Creation of the office of State fish and game warden (Code 1897, sec. 2539).

Maine.—Law requiring guides to register with commissioners of inland fisheries and game (chap. 262).

Massachusetts.—Law prohibiting use of birds for millinery purposes (chap. 524).

Michigan.—Concurrent resolution providing for a committee of one senator and two representatives to act with State game warden and chairman of board of fish commissioners to secure uniform legislation in Michigan, Wisconsin, Minnesota, and Illinois (p. 446).

Acts prohibiting the killing of wildfowl from any floating device propelled by steam, gas, naphtha, oil, or electricity (Act 83, sec. 1); or by use of floating or stationary batteries or mines or pneumatic boats (Act 159, sec. 15); or the killing of any game birds with deadfalls, baited hooks, drugs, chemicals, or explosives (Act 159, sec. 16). (For description and figure of a pneumatic boat see Am. Field, XLIV, p. 124, Aug. 3, 1895.)

Montana.—Penalty for killing buffalo, moose, and other game protected throughout the year, two years in State prison, thus making the offense a felony (H. B. 123, sec. 1).

Sale of all protected game prohibited, one of the first laws of the kind (p. 253, sec. 19).

New Mexico.—Act prohibiting sale of game killed in the Territory (Comp. Laws, p. 394, sec. 1362).

New York.—Law prohibiting for five years jacking and killing deer in water.

North Carolina.—Extreme type of local legislation: "Act to allow N. W. Craft to collect birds on his own premises at any time of the year" (Pub. Laws, chap. 95).

Comprehensive law for wildfowl in Currituck County; noncitizens of the State prohibited from hunting from any box, battery, or float not on land; rest days provided; all persons prohibited from rowing or sailing on Sunday to locate birds for future day; unlawful for any hired person to sail around or interfere with a citizen shooting (chap. 291).

South Dakota.—Comprehensive law protecting big game. Nonresidents prohibited from hunting big game; year 1900 and each fifth year thereafter closed; young protected indefinitely and females until Oct. 1, 1901; uniform open season in October and November except as noted (chap. 66). Repealed 1899 (chap. 91).

Utah.—Creation of the office of State fish and game warden (chap. 46).

1897. West Virginia.—Creation of the office of game and fish warden (chap. 13).

Wisconsin.—Adoption of a nonresident license system (chap. 221); and provision prohibiting killing deer in the water or on the ice (chap. 188).

Hallock Code of cooperative legislation advocated by Charles Hallock before the National Game, Bird, and Fish Protective Association (Western Field and Stream, I, p. 232, 1897).

1898. Congress.—Introduction of the Hoar bill (S. 1383) "for the protection of Song Birds," prohibiting importation or interstate commerce in plumage or sale of plumage in the Territories or District of Columbia.

Georgia.—Act to prevent the baiting or killing of doves on grounds thus baited (No. 13).

Maryland.—General game law containing provisions prohibiting the sale and possession of plumage (chap. 206).

Massachusetts.—Amendment of the millinery law (chap. 339).

Missouri.—Decision in case of Haggerty *v.* St. Louis Ice Manufacturing Co., involving the storage of game (44 S. W., 1114; 143 Mo., 238).

Oregon.—Act for the better protection of grouse and prairie chicken and prohibiting hunting when tracking snow is on the ground (S. B., 48, p. 21).

Organization of the League of American Sportsmen.

1899. Colorado.—Provisions prohibiting use of steel-pointed bullets in hunting deer and requiring packages of fish and game to be marked so as to show nature of contents (chap. 98, Div. B, sec. 7, and Div. D, sec. 14).

Idaho.—Creation of the office of fish and game warden (p. 428).

Illinois.—Establishment of the office of game commissioner (p. 222, sec. 17).

Decision of the U. S. Circuit Court in the case of In re Eberle, sustaining the nonresident license law (98 Fed., 295).

Indiana.—Establishment of the office of the commission of fisheries and game (chap. 31). Officers of other States authorized to seize in Indiana game illegally shipped from their own States (chap. 125).

Maryland.—Decision in the case of Stevens *v.* State (43 Atl., 929).

Minnesota.—$25 nonresident and 25-cent big game resident license, the latter the lowest resident license ever established (chap. 222).

North Carolina.—Reenactment of law of 1891, repealed in 1895, providing gamekeepers for Currituck County (chap. 242). Law prohibiting shooting wildfowl on Currituck Sound over decoys of any kind, Mar. 31 to Nov. 10; putting decoys in water before sunrise; or ring shooting boobies or ruddy ducks, Nov. 10 to Feb. 15 (chap. 245). Ten laws prohibiting hunting on the lands of another without written permission of the owner in 12 counties (chaps. 61, 192, 196, 200, 205, 279, 289, 360, 477, 545).

Oklahoma.—Creation of the office of Territorial game and fish warden (chap. 15, secs. 16–19).

Rhode Island.—Commission on birds established (p. 679).

Washington.—Establishment of the Mount Rainier National Park (30 Stat., 993).

Wisconsin.—Provision requiring packages of fish and game to be marked so as to show nature of contents and name and address of shipper; boats, lights, swivel guns, rafts, and blinds in open water declared public nuisances; game officials of other States designated as agents of Wisconsin and authorized to seize game in Wisconsin illegally shipped from their own States (chap. 312, secs. 8, 19, 24, 27).

Wyoming.—Provisions for guide licenses and absolute protection for swans (chap. 19).

1900. Congress.—Passage of the Lacey Act, May 26 (first Federal law regulating the importation of birds and animals and interstate traffic in game, and requiring packages of game to be marked so as to show name and address of shipper and contents) (31 Stat., 187).

1900. **Alaska.**—Prohibition of destruction, possession, or export of eggs of cranes, ducks, brant, or geese (31 Stat., 332, sec. 29).

California.—Organization of the California Game and Fish Protective Association (May 26).

Maine.—Decision in the case of State *v.* Snowman, involving the guide license law (46 Atl., 815; 94 Me., 99).

Maryland.—Seizure of 2,600 gulls and terns in Baltimore in October (Bird Lore, II, p. 203).

New York.—Decision in the case of People *v.* Buffalo Fish Co. (58 N. E., 34).

Law prohibiting nonresidents from taking fish or game on fresh waters forming part of State boundary, except under same conditions or fees as are required of citizens of New York in State of nonresident (chap. 429).

Organization of the North American Fish and Game Protective Association.

First publication by U. S. Department of Agriculture of table of close seasons, bulletin on game laws, and directory of game officials.

1901. **Alabama.**—Adoption of new constitution containing provision prohibiting local legislation (sec. 106).

Arizona.—One of the last records of elk in the Territory. "A local hunter found the trail of a bull elk near the head of Black River [in the White Mountains] the present autumn (1901), and followed it for two days without obtaining a shot at the animal." (Nelson quoted by Mearns, Bull. 56, U. S. Nat. Mus., p. 216, 1907.)

Florida.—A. O. U. "model law" protecting nongame birds (chap. 4957).

Maine.—Law to prevent criminal carelessness in hunting by providing a penalty for wounding or killing any human being of imprisonment not exceeding 10 years or fine not exceeding $1,000 (chap. 263). Act prohibiting nonresidents from camping or hunting on wild lands of the State from May to November, inclusive, unless in charge of a registered guide (chap. 278).

Michigan.—General revision of the game law, including provisions prohibiting sale of all protected game and use of cages to capture game (No. 217).

Missouri.—Nonexport law (p. 131).

Montana.—Board of game and fish commissioners replaced by the State game and fish warden (H. B. 147).

Nebraska.—General game law, establishing game and fish commission, making the governor commissioner, declaring game the property of the State (sec. 9), establishing licenses, and modifying seasons (chap. 36).

Nevada.—Law requiring oral instruction concerning game protection once a month in the public schools; fish and game laws to be read at least twice each school year; teacher to certify to compliance with act before drawing salary (chap. 47).

New York.—Appropriation of $5,000 for restocking the Adirondacks with moose and elk (chap. 147). Reintroduction of elk; 22 from the preserve of W. C. Whitney liberated in the Adirondacks in June (Rept. Forest, Fish, and Game Comm., 1902–3, p. 322).

North Carolina.—Local law in Mitchell County making it a felony to kill deer in close season or hunt them with dogs at any time in Grassy Creek and Swan Creek townships (chap. 362).

South Dakota.—Requirement that nonresidents, when hunting big game, must be accompanied by a guide who is a deputy game warden (chap. 132).

1902. **Congress.**—Appropriation of $15,000 for purchase of buffalo in Yellowstone Park; 18 cows and 2 bulls purchased and placed in corral near Mammoth Hot Springs.

Federal law authorizing importation of eggs of game birds (Egg Act) under permit of Secretary of Agriculture (32 Stat., 285).

Alaska.—First general game law, including protection for large brown bears (32 Stat., 327).

1902. California.—Adoption of constitutional amendment authorizing division of State into fish and game districts.

Kentucky.—A. O. U. "model law" protecting nongame birds (chap. 54).

Louisiana.—Law prohibiting nonresidents from hunting in the State (chap. 65).

Maryland.—Local law prohibiting hunting on election day in Harford County (chap. 68, sec. 42).

New York.—Provision declaring game law applicable to imported game and providing for bonding game held in possession in close season (Forest, Fish, and Game Laws, sec. 141).

Pennsylvania.—First decision on the Lacey Act (U. S. *v.* Smith, 115 Fed. 423).

Vermont.—Fund of $1,000 contributed by M. E. Wheeler, of Rutland, to enable commissioner of fish and game to pay claims for damage done to crops by deer (Rept. Comm. Fish and Game, 1904, p. 15).

Organization of the National Association of Audubon Societies.

Organization of the National Association of Game and Fish Wardens.

1903. Congress.—Appropriation of $1,000 for transferring elk to the Sequoia National Park (32 Stat., 1161).

Florida.—Creation of first national bird reservation by Executive Order, Mar. 14, setting aside Pelican Island in Indian River, Florida.

Georgia.—Revision of the game law and provision for county wardens (No. 447).

Illinois.—Prohibition of sale of waterfowl killed in the State (p. 206).

Maine.—Adoption of $15 nonresident license for big game; commissioners of inland fisheries and game authorized to adjust and pay from license receipts claims for damage done by deer (chap. 99). Codification of game law in revised laws adopted at special session, in effect Jan. 1, 1904.

Massachusetts.—Prohibition of spring shooting of shorebirds (chap. 162). County commissioners authorized to allow bills for damage by deer, and such bills to be paid from the treasury of the Commonwealth (chap. 407).

Michigan.—Law providing penalty of $1,000 or not more than 10 years imprisonment for careless shooting of human beings (No. 121). Repealed in 1911.

Nevada.—County commissioners authorized to shorten or change seasons for certain game.

New Mexico.—Creation of the office of game and fish warden (chap. 48).

New York.—Brown law prohibiting spring shooting (chap. 256).

North Carolina.—Adoption of the A. O. U. "model law" for the protection of nongame birds and incorporation of the Audubon Society with the powers of a game commission (Private Laws, chap. 337).

North Dakota.—Administration of game laws given to two district wardens (chap. 103).

Pennsylvania.—First alien-license law (No. 136).

Tennessee.—General game law providing for the office of State warden; a reciprocal nonresident license, and $25 market-hunting license; repeal of local game laws (chap. 169). A. O. U. " model law " (chap. 118).

Texas.—General game law, including A. O. U. "model law" and repeal of county laws (chap. 137).

Virginia.—General game law, including A. O. U. "model law" for the protection of nongame birds, provision for the district wardens, and repeal of county laws (chap. 227).

Publication of New York Public Library " List of Works on Sport and Shooting," the most complete bibliography of the subject thus far issued.

1904. Congress.—Introduction of Shiras bill (H. R. 15601) "To protect the migratory game birds of the United States" (for brief on Federal jurisdiction of migratory birds see Forest and Stream, LXVII, p. 815, Nov. 24, 1906).

1904. Alaska.—Regulations of Secretary of Agriculture establishing three game districts (Biol. Surv. Cir. 42).

Arkansas.—Decision in case of State *v.* Mallory (83 S. W., 955), involving the prohibition of hunting in the State by nonresidents, and declaring the act unconstitutional in so far as it prevented them from hunting on their own land.

Colorado.—Decision in Hornbeke *v.* White (76 Pac., 926) relative to possession of hides.

Illinois.—Decision in Cummings *v.* People (71 N. E., 1031; 211 Ill., 392) sustaining the nonresident license law.

Kentucky.—Adoption of reciprocal license (chap. 48); provision for county game wardens (chap. 68).

Louisiana.—Adoption of the A. O. U. "model law" protecting nongame birds, and permission for nonresidents to hunt in the State under license (No. 48). Close term for five years on the wood duck (No. 126, sec. 7.)

Massachusetts.—Authorizing search with warrant (chap. 367).

Minnesota.—Decision in State *v.* Poole (100 N. W. 647) involving a fine of $20,000 for illegal possession of 2,000 ducks.

Mississippi.—Adoption of the A. O. U. "model law" (chap. 98).

Nebraska.—Decision in McConnell *v.* McKillip (99 N. W., 505) involving the confiscation of guns.

New York.—Prohibition of spring shooting of shorebirds (chap. 588); close season for black bears, July to September, inclusive (chap. 630); provision for restocking Adirondacks with moose and elk (chap. 587). (See 1901).

Ohio.—Codification of the game law, placing all shorebirds on the game list, prohibiting shooting of quail or doves on the ground, protecting nongame birds, reorganizing the warden service, and authorizing search without warrant (p. 463).

1905. Congress.—Establishment of the Wichita Game Preserve, Oklahoma (33 Stat., 614).

California.—Killing elk declared a felony punishable by not more than two years' imprisonment (chap. 239).

Illinois.—Decision in the case of Schulte *v.* Warren (75 N. E., 783), involving the right of landowners to protect overflowed land.

State game farm established in February on a tract of 400 acres, 16 miles south of Springfield (Ill. Arbor and Bird Day Ann., p. 81, 1909).

Kansas.—Adoption of the license system and creation of the office of State game warden (chap. 267).

Massachusetts.—Adoption of alien licenses (chap. 317).

Minnesota.—Hunting accidents due to careless handling of firearms defined as manslaughter (chap. 125). General game law containing provisions prohibiting storage of game and extending absolute protection to caribou (chap. 344).

Missouri.—Game law including the A. O. U. "model law" for the protection of nongame birds and provisions prohibiting sale or export (p. 158).

Montana.—Adoption of a uniform season for all game, Sept. 1 to Dec. 1 (chap. 52). (See Michigan, 1869.)

New York.—Amendment to Penal Code prohibiting sale or gift of firearms or air guns to persons under 16, and prohibiting aliens from carrying firearms in public places (Penal Code, secs. 409–410).

North Carolina.—Provision prohibiting capture or killing of deer in the water (Code, sec. 3462.)

Oklahoma.—Provision in school law requiring instruction at least half an hour each week concerning habits and protection of animals and birds (chap. 33, art. 12, sec. 2).

1905. **Oregon.**—Acts prohibiting sale of practically all game (chap. 117) and fixing open season by days of the week (chap. 77).

South Carolina.—Provision for county game wardens (No. 489).

Tennessee.—Creation of the department of game, fish, and forestry in charge of a State warden, appointed for eight years (chap. 455).

Wisconsin.—General civil-service law applying the merit system to the game-warden service as well as other departments of the State government (chap. 363).

Wyoming.—Act creating a State game preserve south of the Yellowstone National Park (chap. 90). Provision requiring license to photograph big game in winter (Rev. Stat., sec. 2117).

Incorporation of the National Association of Audubon Societies.

Organization of the American Bison Society.

Extensive feeding of game birds, especially in Illinois, Massachusetts, and Pennsylvania during winter of 1904–05 (Yearbook Dept. Agr., 1905, p. 615.)

1906. **Congress.**—Act protecting birds on bird reservations (34 Stat., 536); establishment of the Grand Canyon Game Preserve, Arizona (34 Stat., 607); appropriation of $15,000 for fencing the Wichita Game Preserve (34 Stat., 696).

Arkansas.—Decision in case of Wells Fargo Exp. Co. *v.* State (96 S. W., 189), construing nonexport law.

District of Columbia.—Act of Congress prohibiting hunting except on the Eastern Branch and on the west shore of the Potomac (34 Stat., 808).

Massachusetts.—Laws prohibiting use of live decoys in Nantucket County (chap. 292) and sale of imported ducks, quail, and prairie chickens in close season (chaps. 301, 303, 304). Introduction of three bills to regulate keeping of cats (all of which failed).

Mississippi.—Adoption of a general game law containing license, nonexport, and nonsale provisions (Code, secs. 2323–2336).

New York.—Defeat of the spring-shooting bill and so-called Silz bill permitting sale of imported game in close season (Forest and Stream, LXVI, pp. 415, 753, 1906).

Wyoming.—Incursion of Ute Indians from Colorado resulting in great destruction of game (Ann. Rept. State Game Warden, 1906, 617.)

Introduction of bills to prohibit the use of automatic guns in hunting game in eight States and the District of Columbia (all of which failed).

1907. **Alabama.**—Adoption of a general game law including the A. O. U. "model law" for the protection of nongame birds, prohibiting sale and export, requiring resident and nonresident licenses, establishing the elective office of State game and fish commissioner, and repealing all local laws (No. 18). This law stopped the last of the large shipments of quail for restocking purposes.

California.—Adoption of the resident, nonresident, and alien license system (chap. 206).

Connecticut.—Adoption of a complete license system (chap. 153).

Louisiana.—Decision in case of State *v.* Schwartz (44 S., 20), sustaining the constitutionality of the law prohibiting sale of imported plumage.

Massachusetts.—Provision requiring use of buckshot in killing deer (chap. 307).

Michigan.—Addition of fire protection to the duties of State warden and increasing salary to $3,000 (No. 264).

Minnesota.—Act to prohibit the shooting of firearms within 3 miles of the corporate limits of cities having a population of 50,000 or more (chap. 300).

Missouri.—Law abolishing regular deputy wardens and repeal of many provisions of the Act of 1905 (p. 277); and providing for calling a grand jury annually in each county to investigate violations of the game law (p. 320).

Montana.—Sale of Pablo herd of buffalo to Canadian Government, and transfer of 410 head to Elk Island Park, Alberta (Byshe, 4th Ann. Rept. Am. Bison Soc., p. 38, 1911).

1907. **New Hampshire.**—Provision requiring use of buckshot in hunting deer except in Carroll, Coos, and Grafton counties (chap. 130).

New York.—Defeat of the foreign game importation or Silz bill (Forest and Stream, LXVIII, p. 895, June 8, 1907).

Oklahoma.—Transfer to Wichita Game Preserve of herd of 15 buffalo presented by the New York Zoological Society (Rept. Am. Bison Soc., p. 55, 1908).

Pennsylvania.—Establishment of game refuges on State forest reserves (No. 64); law prohibiting use of automatic guns in hunting game (No. 244).

South Carolina.—Incorporation of the Audubon Society with powers of a game commission and provision for wardens (chap. 315).

Texas.—Jurisdiction of fish and oyster commissioner extended to include game; establishment of $15 nonresident license (chap. 379).

West Virginia.—Adoption of the A. O. U. "model law" for the protection of nongame birds (chap. 57).

Wyoming.—Conviction of noted tusk hunters in the Yellowstone National Park. Act making head hunting and tusk hunting a felony (chap. 47).

Memorial praying the Benevolent and Protective Order of Elks to discourage the hunting of elk for tusks (House Joint mem. No. 1, p. 196).

Discovery of quail disease (*Colibacillosis tetraonidarum*) in birds from Alabama, Kansas, and Oklahoma (Yearbook Dept. Agr., p. 595).

Introduction of bills to prohibit use of automatic guns in hunting game in 17 States (all failed except that in Pennsylvania).

Vetoes: California, bills establishing bird day and a game commission; New York, protecting gray squirrels throughout the year and appropriating $20,000 for a buffalo herd in the Adirondack Park; Oregon, allowing fruit growers to destroy birds injuring their orchards.

1908. **Congress.**—Appropriation of $30,000 for land and $10,000 for fencing for National Bison Range in Montana (35 Stat., 267).

Introduction of the Weeks bill (H. R. 22888) "To protect migratory game birds of the United States."

Alabama.—Decision in Hyde *v.* State (46 S., 489), upholding the law prohibiting hunting on lands of another without written permission.

Alaska.—General game law, including provisions authorizing governor to appoint wardens and to issue licenses (nonresident, $50; alien, $100; shipping moose, $150; shipping licenses, $5-$150) (35 Stat., 102).

California.—Introduction of wild turkeys from Mexico (Biol. Surv. Cir. No. 80, p. 22, 1911).

Louisiana.—Adoption of the resident license system (No. 277).

New Jersey.—Division of State into two districts and prohibition of spring shooting in the northern counties (chap. 222).

Kansas.—Act passed at extra session protecting deer and antelope for 10 years (chap. 59).

New York.—Codification of the entire game, fish, and forestry law and the adoption of the $1 resident license (chaps. 130, 471).

Vermont.—Authorizing the governor to suspend the hunting season in times of drought (No. 13). Season suspended 17 days and deer season postponed two weeks.

Decision of the Supreme Court of the United States in New York ex rel Hesterberg *v.* People (211 U. S., 31), involving the right of the State to regulate the sale of imported game.

Fort Niobrara Military Reservation, Nebr., containing 55,000 acres, practically made a game refuge; by order of the President, the War Department prohibited hunting on the reservation (Bird Lore, X, p. 144).

Inauguration of the "More Game" movement by the Amateur Sportsman.

1909. **Congress.**—Enactment of Criminal Code (to take effect Jan. 1, 1910), containing important amendments to the Lacey Act (35 Stat., 1137).

Appropriations: $7,000 for bison and bird reservations, and $9,420 for enforcement of Lacey Act (35 Stat., 1051); $10,000 for protection of game in Alaska (35 Stat., 990).

Twenty-six national bird reservations; Mount Olympus National Monument in Washington for elk; and Fire Island Reservation, in Alaska, for moose, established by Executive orders.

California.—Establishment of a game refuge on the Pinnacles National Forest (chap. 428). Defeat of Stuckenbruck bill to remove protection from meadowlarks. Provision prohibiting the use of any animal except a dog as a blind in hunting waterfowl or shorebirds (chap. 395).

Idaho.—Establishment of a game refuge on the Payette River (H. B. 242), and appropriation of $15,000 from game fund for purchase of Heyburn Park, on the Coeur d'Alene Indian Reservation (H. B. 186).

Illinois.—Provisions prohibiting baiting of ducks and allowing only one-half bag limit to boys under 12 (p. 236).

Maine.—Authorizing governor to prohibit use of firearms in forests during droughts (chap. 52), and prohibiting use of silencers (chap. 129).

Massachusetts.—Adoption of a resident license system (chap. 262), authorizing governor to proclaim close season in time of drought (chap. 421).

Minnesota.—Making the Minnesota State forest reserve lands and parks and the national forests game refuges (chaps. 171, 320).

Missouri.—Adoption of a comprehensive game law, reenacting many of the provisions of the law of 1905, and increasing the nonresident license fee from $15 to $25 and the resident license fee from $2.50 to $5 (p. 519).

Montana.—Completion of National Bison Range in Montana, on which were placed 37 buffalo donated by the American Bison Society (3d Ann. Rept. Am. Bison Soc., p. 1, 1910).

New Jersey.—Open season for deer after a continued close term of ten years but hunting deer with rifles, or shotguns smaller than No. 12, prohibited (chap. 187).

New Mexico.—Adoption of a resident and nonresident license system (chap. 83).

New York.—Decision in the case of Dieterich *v.* Fargo (87 N. E., 518), involving the right to sell deer raised in captivity. Law authorizing governor to prohibit hunting in forest-reserve counties during droughts (chap. 474).

North Carolina.—Passage of 79 game laws, all but two, local acts, the maximum number in any one State in one year.

North Dakota.—Law prohibiting use of silencers (chap. 122); prohibiting spring shooting, and creating game and fish board of control (chap. 128).

Pennsylvania.—Prohibiting unnaturalized foreign-born residents from hunting in the State or owning guns or rifles (No. 261).

Tennessee.—Attempt to depose the State warden by making the commissioner of agriculture ex officio warden under the Langford bill (chap. 519), which was declared unconstitutional (Acklen *v.* Thompson, 126 S. W., 730). Provision for acquisition of Reelfoot Lake as a fish and game preserve (chaps. 371, 463, 534).

Texas.—Act passed at extra session providing for resident license (chap. 27).

Utah.—Codification of the game law, repealing protection for does, reducing the nonresident license fee to $5, and establishing a $100 alien license (chap. 53).

Vermont.—Law permitting the killing of does after a continuous protection of 44 years (No. 146).

Washington.—Provision prohibiting use of silencers (Crim. Code, sec. 265).

General game law passed at the extra session containing a prohibition of the storage of game (ext. sess., chap. 12).

1909. **Wisconsin.**—First competitive oral examinations for position of deputy game warden held by Civil Service Commission.

Wyoming.—Appropriation of $5,000 for purchase of feed for elk and other big game (chap. 59). Memorials requesting Congress to grant certain lands for winter refuges for big game (No. 2), and requesting the State of Idaho to create a game refuge contiguous to the Wyoming State game preserve (No. 4).

Practical removal of antelope from the game list by the closing of the seasons in Montana, Nevada, Oregon, and Wyoming.

1910. **Congress.**—Establishment of Glacier National Park, Mont. (36 Stat., 354).

Florida.—First decision of supreme court on game law, Harper *v.* Galloway (51 S., 226), declaring local nonresident license law for Marion County inoperative as to residents of Florida.

Louisiana.—Reorganization of game commission (No. 265), and provision for two State game preserves (No. 273).

Maryland.—Uniform season for wildfowl (chap. 251), and establishment of bag limits (chap. 337).

Massachusetts.—First open season on deer for several years in five counties in western part of the State (chap. 545); authorization of search without warrant (chap. 548).

Mississippi.—Decision in State *v.* Hill (53 S. 411), declaring unconstitutional the local ordinance of Itawamba County prohibiting hunting by nonresidents except on their own land.

Missouri.—Establishment of State game farm at Jefferson City; creation of office of millinery expert.

New York.—Close season on deer on Long Island for 3 years, repeal of special buck law permitting bucks to be killed first 15 days in November, and prohibition of spring shooting of brant for 3 years (chap. 657).

Passage of the Shea plumage bill (to take effect July 1, 1911). This bill prohibits possession or sale of aigrettes or other plumage of birds belonging to same families as birds of New York (chap. 256).

Oklahoma.—Decision of United States Circuit Court of Appeals in Rupert *v.* United States (181 Fed., 87), sustaining the Oklahoma law and construing the Lacey Act.

Pennsylvania.—Decision in Commonwealth *v.* McComb (76 Atl., 100), sustaining constitutionality of law prohibiting use of automatic guns in killing game.

South Carolina.—Provision for appointment of a chief game warden (No. 293).

Wyoming.—Transfer of 25 elk from Jackson Hole to Big Horn game preserve at a cost of about $1,300 (Ann. Rept. State Game Warden, 1910, p. 7).

Arrest of 23 Japanese poachers on Laysan Island, in the Hawaiian Bird Reservation. These men had destroyed nearly 300,000 birds during the summer and autumn of 1909. They were brought to Honolulu by the revenue cutter Thetis and later deported to Japan, and the plumage which they had collected was confiscated.

Duck disease (cholera or coccidiosis) prevalent locally in Utah, Colorado, and California (Cir. 80, Biol. Surv., p. 15, 1911).

First use of the aeroplane in hunting game birds on grounds of the Bolsa Chica Club, Orange County, California (Forest and Stream, LXXV, p. 1047, Dec. 31, 1910).

National Association Game Commissioners' convention in New Orleans (Am. Field, LXXIII, p. 169, Feb. 19, 1910).

Vetoes: New Jersey, general game bill exempting warden service from civil-service law.

Publication of W. T. Hornaday's "Sportsman's Platform," containing 15 cardinal principles affecting wild game and its pursuit (Field and Stream, Vol. XV, p. 179, June, 1910).

1911. Congress.—Act creating the Appalachian Park (36 Stat., 961); appropriation of $20,000 for feeding, protecting, and removing elk from Jackson Hole, Wyo. (36 Stat., 1258). (See also Arizona.)

Arizona.—Protection accorded antelope under Territorial law extended by act of Congress until March 1, 1913 (36 Stat., 912, sec. 6).

California.—Division of the State into 6 game districts (chap. 241); investigation of the game commission (Western Field, vol. 17, pp. 40–56, May, 1911).

Delaware.—General revision of the game laws; provision for enforcing the laws by a board of game and fish commissioners instead of by the Delaware Game Protective Association (chap. 162).

Georgia.—General game law providing a license system, bag limits, and office of State fish and game commissioner, and prohibiting sale and export (chap. 238).

Idaho.—Creation of a State preserve for big game by closing the season for five years in Bear Lake, Cassia, Oneida, and Twin Falls Counties (chap. 208).

Illinois.—Close term for woodcock for four years; opening the season on prairie chicken with a bag limit of 3 a day for the first time in eight years; prohibiting the use of rifles for shooting waterfowl; repealing the restrictions on baiting waterfowl; and abolishing the State game fund (H. B. 676).

Kansas.—Act revising the game law and placing the State warden's office under the supervision of the University of Kansas (chap. 198).

Louisiana.—Donation to the State of 15,000 acres in Vermilion Parish by Chas. W. Ward and E. A. McIlhenny as a game preserve (Forest and Stream, Vol. LXXVII, p. 167, July 29, 1911).

Michigan.—Repeal of act providing penalty for careless shooting of human beings (No. 38).

Montana.—Establishment of the Snowy Creek, Pryor Mountain, and Yellowstone game preserves (chaps. 87, 100).

New Jersey.—Adoption of plumage law modeled on Shea bill of New York (chap. 168).

New York.—Passage of the Bayne bill providing for prohibiting the sale of native game, permitting traffic in certain kinds of imported game, and requiring all game to be tagged before being placed on the market (chap. 438); provision for a conservation commission of three members to replace the forest, fish, and game commission, the State water supply commissioner and the forest purchasing board (chap. 647).

Shea plumage law in effect July 1. Attack on law defeated by dismissal by United States circuit court of application for injunction to restrain State officers from enforcing its provisions.

North Dakota.—Acts setting aside the islands in Devils Lake as a bird reserve (chap. 139), establishing a game preserve in the Killdeer Mountains (chap. 143), and prohibiting use of automobiles or rifles in shooting wild fowl (chap. 141).

Oregon.—Acts replacing the office of game and forestry warden by a fish and game commission of five members (chap. 152); providing for the establishment by the governor of bird and game refuges (chap. 264).

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Texas.—Establishment of a game preserve of 1,220,000 acres on the King ranch, in the southwestern part of the State, with more than 100 lodges for rent to the public (Texas Field, Feb., 1911, p. 78).

Vermont.—Laws changing the deer season and protecting does absolutely (No. 193), authorizing the game commissioner to appraise deer on forest land inclosed for a private park, and to sell them to the owner of the park (No. 211).

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Export prohibited, Connecticut (skins), 1677; Minnesota (for sale), 1871; Iowa, 1878; Indiana, 1879; killing or possession with intent to export, Wisconsin, 1887. (See also Shipment.)
Extermination, elk, Arizona, 1901; wild pigeon, New York (last roost), 1875; wild turkey, New York, last record, 1844.

Extra-session legislation, nonresident license, Arkansas, 1875; (increase in market hunting license, Arkansas, 1897); close terms for deer and antelope, Kansas, 1908; (7 local laws, North Carolina, 1908); resident license, Texas, 1909; general game law, Washington, 1909.

Fake (see Duck-egg fake).

Farallon Islands, California, egg traffic stopped, 1896.

Fawns protected, New York, 1862; 1867.

Feathers (see Plumage).

Federal game law, oldest in force, Indian Territory, 1832.

Federal jurisdiction of migratory birds, Shiras bill, 1904; Weeks bill, 1908.

Feeding game, Illinois, Massachusetts, Pennsylvania, 1905; appropriation, Wyoming, 1909.

Fees, license, nonresident highest $150, moose license, Alaska, 1908.

  Nonresident lowest $5, Utah, 1909.

  Reciprocal, New York, 1900; Tennessee, 1903; Kentucky, 1904.

  Resident highest $5, Missouri, 1909.

  Resident lowest 25 cents, Minnesota, 1899.

Felony, killing buffalo, moose, and other game protected throughout the year, Montana, 1897; killing deer in close season or hunting them with dogs in two townships in Mitchell County, N. C., 1901; killing elk, California, 1905; head hunting and tusk hunting, Wyoming, 1907.

Female deer, elk, etc., protected, California, 1883; South Dakota, 1897. (See also Does).

Ferrets, use prohibited in hunting rabbits, Rhode Island, 1860; Connecticut, 1865; West Virginia, 1869.

Fines, changed from continental currency to English (?) currency, Vermont, 1780.

Firearms, use by slaves, Florida, 1828; carelessness in handling, Maine, 1901; Minnesota, 1905; sale or gift to persons under 16 prohibited, New York, 1905; not to be carried by aliens in public places, New York, 1905; use within 3 miles of cities, Minnesota, 1907.

Fire hunting prohibited, Maryland, 1730; South Carolina, 1769, 1785–1788, 1789; North Carolina, 1777, 1779, 1784; Georgia, 1790; Virginia, 1792; Mississippi, 1803; Alabama, 1803, 1822; Florida, 1828.

Fire protection made duty of State warden, Michigan, 1907.

Fish commissioners, jurisdiction extended to game, California, 1878; Massachusetts, 1886; Colorado, 1891; Wyoming, 1895; Texas, 1907.

Fish commission reorganized as fish and game commission, Vermont, 1892.

Fish and Game League, Vermont, 1890.

Fish and game warden, Iowa, 1897; Utah, 1897; Idaho, 1899.

Fish and game warden department, Michigan, 1887; Tennessee, 1905.

Fish and oyster commissioner, jurisdiction extended to game, Texas, 1907.

Fish hawk protected, New York, 1862, 1867; New Jersey, 1885.

Florida, laws prohibiting fire hunting, 1828; slaves prohibited from using firearms to kill game, without weekly license 1828, camp hunting, 1851; Sunday hunting, 1859; hunting permission law, 1866; nonresident licenses, 1875; plume birds, 1877; nonexport law, 1893; manatee protected, 1893; county wardens, 1897; A. O. U. law, 1901; first national bird reservation, 1903; decision in Harper *v.* Galloway (county license), 1910.

Forest and Stream established 1873; antisale plank adopted, 1894.

Fort Niobrara Military Reservation a game refuge, 1908.

Fruit growers allowed to destroy birds injuring their crops, bill vetoed, Oregon, 1907.

Fur, Fin, and Feather, Suydam, 1868.

Game birds, defined, New York, 1886; Pennsylvania, 1889; Indiana, 1891 (see also A. O. U. "model law"); sale in close season prohibited, New York, 1862; protected, Maine, 1863; shipment restricted, Iowa, 1874.

Game and fish commission established, Nebraska, 1901; reorganized, Louisiana, 1910.

Game and fish protector, Oregon, 1893.

Game and fish warden, Missouri, 1895; West Virginia, 1897; New Mexico, 1903.

Game commissioner, Illinois, 1899.

Game constable, New York, 1871; Wyoming, 1890.

Game districts (see districts).

Game farm, Illinois, 1905.

Game, fish, and forestry department, Tennessee, 1905.

Game for bait, use of elk, deer, or antelope prohibited, Colorado, 1893.

Game fund (see State game fund).

Gamekeepers, Currituck County, N. C., 1891; law (repealed, 1895); reenacted, 1899.

Game law, first:

  New York, 1629 (hunting privilege); 1705 (close season).

  Massachusetts, 1647 (hunting privilege); 1694 (close season).

  Connecticut, 1677 (export); 1698 (close season).

  New Jersey, 1678 (privilege of hunting on unsurveyed lands; 1722 (first protection of game).

  Virginia, 1699.

  Rhode Island.

  Pennsylvania, 1721.

  Delaware, 1721.

  Maryland, 1730.

  North Carolina, 1738.

  New Hampshire, 1741.

  South Carolina, 1755 (nonresidents).

  Vermont, 1779.

  Georgia, 1790.

  Mississippi, 1803.

  Alabama, 1822.

  Florida, 1828.

  Maine, 1830.

  Indian Territory, 1832.

  Missouri, 1851.

  Wisconsin, 1851.

  California, 1852 (local); 1854.

  Illinois, 1853.

  Indiana, 1857.

  Iowa, 1857.

  Louisiana, 1857.

Game law, first—Continued.
  Ohio, 1857.
  Minnesota, 1858.
  Michigan, 1859.
  Nebraska, 1860.
  Texas, 1860.
  Kansas, 1861.
  Kentucky, 1861.
  Nevada, 1861.
  Idaho, 1864.
  Washington, 1865.
  Colorado, 1867.
  West Virginia, 1868.
  Wyoming, 1869.
  Montana, 1870.
  Tennessee, 1870.
  Oregon, 1872.
  Utah, 1872.
  Arkansas, 1875.
  North Dakota, 1875.
  South Dakota, 1875.
  District of Columbia, 1878.
  New Mexico, 1880.
  Arizona, 1887.
  Oklahoma, 1890.
  Alaska, 1900 (eggs), 1902.
Game law publications, Dodge's Digest of Bird and Game Laws, 1865; Suydam's Fur, Fin, and Feather, 1868; first pamphlet editions of game laws, New York, 1873; first close season table, 1873; Forest and Stream, 1873; Hallock's Bibliography for Sportsmen, 1880; Smith's Law of Field Sports, 1886; Reynold's Book of the Game Laws, 1890; New York Public Library List of Works on Sport and Shooting, 1903. (See also Publication of game law.)
Game preserve (National), Wichita, Oklahoma, 1905; Grand Canyon, Arizona, 1906; (private), Caton preserve, Illinois, 1858; Blooming Grove Park, Pa., 1871. (State) Wyoming, 1905.
Game, property of State, principle first enunciated in Magner *v.* People, Illinois, 1881; incorporated in game law, Arkansas, 1889; established by Supreme Court of United States in Geer *v.* Connecticut, 1896; stated in game law, Nebraska, 1901.
Game refuges, Wyoming, 1905; Pennsylvania, established on State forest reserves, 1907; California, on Pinnacles National Forest, 1909; Idaho, on Payette River, Heyburn Park, and Cœur d'Alène Indian Reservation, 1909; Minnesota State forest reserves and parks, 1909; Wyoming, Congress memorialized for winter refuge, 1909; Louisiana, 1910; Idaho, 1911; Louisiana, 1911; Montana, 1911; North Dakota, 1911; Oregon, 1911; Washington,, 1911.
Game warden (State), Minnesota, 1887; Wisconsin (4), 1887; Washington, 1890; Illinois, 1895; Maryland, 1896.
General Grant National Park, Cal., established, 1890.
Georgia, prohibition of fire hunting, 1790; Black Act decision (State *v.* Campbell), 1808; 2-year close season for deer in Screven County, 1859; discharge of firearms on highway at night, 1883; general law for deer, turkeys, partridges, and pheasants, but not to modify local laws, 1891; act of 1891 made uniform throughout State, 1893; close season on opossums, 1897; baiting doves, 1898; revision of game law, county wardens, 1903; general game law, 1911; license system, 1911; fish and game commissioner, 1911.
Glacier National Park, Mont., established, 1910.
Goose, close season, Ohio, 1857; Nevada, 1861.
Governor, salary paid in deer skins, Tennessee, 1787; as Fish and Game Commissioner, Nebraska, 1901; authorized to issue licenses, Alaska, 1908; authorized to suspend open seasons in time of drought, Vermont, 1908; Massachusetts, 1909; authorized to prohibit hunting in forests in time of drought, Maine and New York, 1909.
Grain, permission required to enter upon growing crops, Minnesota, 1864.
Grand Canyon game preserve, Arizona, 1906.
Grand jury to investigate game law violations, Missouri, 1907.
Grass plover (see Upland plover).
Ground, shooting quail and doves on the ground prohibited, Ohio, 1904.
Grouse, close season, New York, 1785; New Jersey, 1820.
Guests of citizens of Dorchester County allowed privileges of shooting wildfowl (Maryland, 1892).
Guides, registry law, Maine, 1897; licensed, Wyoming, 1899; required by nonresidents hunting on wild lands, Maine, 1901; required by nonresidents hunting big game, South Dakota, 1901; must be deputy wardens, South Dakota, 1901.
Gulls, protected, New Jersey, 1885; seized in Baltimore, Md., 1900.
Guns, automatic, Pennsylvania, 1907; decision sustaining constitutionality of law, Pennsylvania, 1910; big guns, Virginia, 1833; New York, 1869; North Carolina (Currituck County), 1870; Maryland (Susquehanna Flats), 1872; Wisconsin, 1887.
Guns, rifles on Core Sound, N. C., 1893.
Guns, swivel or punt, Michigan, 1865.
Guns, spring, prohibited, Minnesota, 1869; Wisconsin, 1887.
Hallock, Charles, Bibliography for Sportsmen, 1880.
Hallock Code, 1897.
Hawk protected, New York, 1886. (See also Fish hawk.)
Heath hen, first close season, New York, 1708; New York, 1785; New Jersey, 1820; Massachusetts, 1831; Rhode Island, 1846; close term 6 years, Massachusetts, 1870.
Heyburn Park, Idaho, 1909.
Hides, export prohibited, Connecticut, 1677; killing for hides prohibited, Oregon, 1874; decision on law prohibiting sale, Colorado, 1904.
Highways, watching for deer near highways at night, New York, 1803; hunting on, prohibited, Kentucky, 1861; Kansas, 1886, discharge of firearms prohibited at night, Georgia, 1883.
Hoar bill, Congress, 1898.
Hornaday, W. T., Sportsman's Platform, 1910.

Hounding in close season, Virginia, 1856; at any season, Barnstable County, Massachusetts, 1802; New York, 1869; Indiana, 1879; New York (in part), 1886; Michigan, 1887; Washington, 1890.

Hunting; for the various forms of hunting prohibited in certain States, see the following headings: Baited hooks; baiting doves; bull hunting; bullets; camp hunting; decoys; dogs; explosives; ferrets; fire hunting; ground; guides (without); hide hunting; hounding; ice; jacking; night hunting; open-water shooting; poisons; ring shooting; set guns; snow hunting; sulphur; Sunday hunting; water.

Hunting accidents, Maine, 1901; Michigan, 1903, 1911; Minnesota, 1905.

Hunting clubs, Blooming Grove Park Association, Pennsylvania, 1871.

Hunting permission law, Florida, 1866.

Hunting on lands without permission, Delaware, 1721; without written permission, Alabama (9 counties), 1891; Indiana, 1891; North Carolina (12 counties), 1899.

Hunting game for sale prohibited, Wyoming, 1890. (See Market hunting.)

Hunting privileges, New York, 1629; Massachusetts, 1647; New Jersey, 1678; owners of shores, Virginia, 1819.

Ice, killing deer on ice prohibited, Wisconsin, 1897.

Idaho, first game law (uniform season), 1864; protection of eagles, 1879; fish and game warden, 1899; State game preserve, 1911.

Illinois, Sunday hunting prohibited, 1821; first game law, 1853; game in captivity, personal property, 1877; decisions in Magner *v.* People, 1881 (sale of imported game, game the property of the State), and American Express Co. *v.* People, 1890 (transportation); game warden, 1895; decision in Merritt *v.* People, 1897 (sale of imported game); game commissioner, 1899; decision in In re Eberle, 1899 (nonresident license); prohibition of sale of waterfowl killed in State, 1903; decision in Cummings *v.* People, 1904 (nonresident license); State game farm, 1905; decision in Schulte *v.* Warren, 1905 (hunting on overflowed lands); prohibiting baiting for ducks, 1909; boys bag limit, 1909; repealed, 1911; close term for woodcock, open season for prairie chicken, abolishing State game fund, 1911.

Imported game, exempt, New York, 1869.

Incorporation, Fowling and Fishing Association, New Jersey, 1813; National Association of Audubon Societies, 1905.

Indiana, Sunday hunting law, 1807; first game law, 1857; netting quail and prairie chickens, 1867; nongame bird law, 1873; hounding prohibited, 1879; nongame birds, 1891; definition of game birds, 1891; written permission, 1891; commissioner of fisheries and game, 1899; authorization of officers of other states, 1899.

Indian raid, Wyoming, 1906.

Indian Territory, first game law, 1832.

Insectivorous birds protected, Connecticut, 1850; New Jersey, 1850; Georgia, 1893. (See also Nongame bird.)

Interference with hunting prohibited on Currituck Sound, N. C., 1897.

International fish and game conferences, New York City, October 12, 1891, and Detroit, Mich., December 20–21, 1891.

Interstate commerce in game, Lacey Act, 1900.

Introduction, California Valley quail in Washington, 1857; bobwhite in Utah, 1871; bobwhite in Idaho, 1875; European quail in New England, 1879; ringneck pheasants in Oregon, 1881; English pheasants in Georgia, 1887; elk in New York, 1901; moose in New York, 1901; wild turkeys in California, 1908.

Investigation of game commission, California, 1911.

Iowa, Sunday hunting prohibited, 1855; first game law, 1857; shipment of game birds restricted, 1874; export prohibited, 1878; first bag limit, 1878; fish and game warden, 1897.

Jacking deer prohibited, Michigan (artificial light), 1887; New York, 1897.

Jack rabbit, close term, Delaware, 1885.

Kansas, first game law, county commissioners may proclaim act inoperative, 1861; nongame birds protected, export prohibited, 1876; decision in State *v.* Saunders, 1877 (export); trespass law, 1886; prohibiting sale of protected birds, 1886; license system, 1905; State game warden, 1905; extra session act protecting deer and antelope, 1908; revision of game law, 1911; warden's office under supervision of university, 1911.

Kentucky, first game laws for game and nongame birds, 1861; A. O. U. "model law," 1902; county game wardens, 1904; reciprocal license, 1904.

Lacey Act, introduced 1897, passed, 1900; first decision, United States *v.* Smith, Pennsylvania, 1902; amendment, 1909; construction, Rupert *v.* United States, Oklahoma, 1910.

Lark, close season, Massachusetts, 1818; protected all the year, Connecticut, 1850; New Jersey, 1850; bill removing protection defeated, California, 1909.

Launches, use of naptha or steam, prohibited in hunting waterfowl, Ohio, 1890.

Law of Field Sports, Smith, 1886.

Lay days (see Rest days).

Laysan Island, destruction of birds, 1910.

League of American Sportsmen organized, 1898.

License fee, nonresident, lowest $5, Utah, 1909; nonresident, highest $150, moose license, Alaska, 1908; nonresident pigeon netting, $50, Pennsylvania, 1878; reciprocal, New York, 1900; Tennessee, 1903; Kentucky, 1904; resident, lowest 25 cents, Minnesota, 1899; resident, highest $5, Missouri, 1909.

License law, adopted first, in the United States, New York, 1864; Arkansas, hunting and trapping, 1875; Michigan, Minnesota, North Dakota, Wyoming, 1895; Wisconsin, 1897; Maine, 1903; Louisiana, 1904; Kansas, 1905; California, 1907; Connecticut, 1907; Texas 1907; Alaska, 1908; New Mexico, 1909.

License law, alien, Pennsylvania, 1903; Massachusetts, 1905; market hunting, Arkansas, 1875; Tennessee, 1903; photographing big game, Wyoming, 1905; pigeon netting (nonresident), Pennsylvania, 1878; reciprocal, Minnesota, 1895; Tennessee, 1903; Kentucky, 1904; guides (registry), Maine, 1897; Wyoming, 1899.

Licking Reservoir, a public park and game preserve, Ohio, 1894.

Limits (birds), Iowa, 1878; (big game), Maine, 1883; (deer), New York, 1886; (big game), Wyoming, 1890.

List of works on sport and shooting, New York Public Library, 1903.

Local legislation, towns authorized to make by-laws for capture of birds, Connecticut, 1833; county supervisors to make ordinances for fish and game, New York, 1849, 1871; county police boards authorized to pass ordinances, Mississippi, 1856; police juries, Louisiana, 1896; prohibited, Nebraska, 1872; prohibited in Territories, 1886; not modified by general law, Georgia, 1891; extreme type, North Carolina, 1897; maximum number of acts in one year, 77, North Carolina, 1909. (See also County supervisors and Constitutional provisions.)

Long Island, protection heath hens, 1785; close term on deer, 5 years, 1862; spring shooting of ducks prohibited, 1903; spring shooting bill defeated, 1906; close term on deer 3 years, 1910; spring shooting of brant prohibited 3 years, 1910.

Louisiana, first game law, 1857; police juries to pass ordinances for protection of game, 1896; nonresidents prohibited from hunting, 1902; A. O. U. law, 1904; decision in State *v.* Schwartz, 1907 (aigrettes); resident license system, 1908; game commission reorganized, 1910; game preserves established, 1910; Ward-McIlhenny preserve, 1911.

Maine, first game law, 1830; decision in case of Peables *v.* Hannaford, 1841 (definition of open seasons); aliens, county moose warden, 1852; birds protected, 1858; caribou, 1870; nongame birds, 1870; close term for moose, 1878–80; jurisdiction of commissioners inland fisheries extended to game, 1880; limits on big game, 1883; guide registry law, 1897; decision in State *v.* Snowman, 1900 (guides); law to prevent criminal carelessness, 1901; nonresidents required to hunt with registered guides, 1901; nonresident license, claims for damage done by deer, revision of game law, 1903; governor may prohibit use of firearms in forests during droughts, 1910; silencers prohibited, 1910.

Manatee, first protection, Florida, 1893.

Manslaughter, accidents due to careless handling of firearms, Minnesota, 1905.

Market hunting, Missouri, 1877; Arkansas, 1875; Wyoming, 1890; Tennessee, 1903.

Marking packages of fish and game, Colorado, 1899; Wisconsin, 1899; Lacey Act, 1900.

Marsh birds, prohibition of sale, Massachusetts, 1836.

Maryland (close season on deer and fire hunting, 1730) decision in Smith *v.* Maryland, 1855; licenses established and board of ducking police created for Susquehanna Flats, 1872; rest days provided, Susquehanna Flats, 1872; guests of citizens of Dorchester County, 1872; game warden, 1896; general game law, 1898; decision in Stevens *v.* State, 1899 (sale imported game); seizure of 2,600 gulls, 1900; prohibiting hunting on election day in Harford County, 1902; uniform season for wildfowl and bag limit laws, 1910.

Massachusetts (hunting privilege, 1647; close season on deer, 1694; close term on deer, 1718–1721; first wardens, 1739; "deer reeves," 1764); hounding prohibited, Barnstable County, 1802; close seasons on partridges and quail, woodcock, snipe, larks, and robins, 1818; prohibiting shooting on salt marshes, Mar. 1 to Sept. 1, 1821; protecting heath hens, 1831; protecting plover, curlew, dough bird, or chicken bird at night, 1835; prohibiting sale of marsh birds in close season, 1836; close term on heath hen, 1837–1841; protecting wild-pigeon netters, 1848; close season plover, curlew, dough bird, 1849; protecting nongame birds, 1855; spring shooting prohibited, 1870; open season for wild pigeons, 1870; deer, close term two years, 1870; permits for collecting specimens, 1870; antispring shooting law repealed, 1871; fish and game protective association organized, 1874; decision in Commonwealth *v.* Hall, 1880 (sale of imported game); deer season limited to four days per week in November, 1882; jurisdiction of commissioners of fisheries extended to game 1886; Audubon Society organized, 1896; use of birds for millinery purposes prohibited, 1897; millinery law amended, 1898; damage by deer, 1903; prohibiting spring shooting of shore birds, 1903; search with warrant, 1904; alien licenses, 1905; use of live decoys in Nantucket County prohibited, 1906; sale of imported game in close season prohibited, 1906; three cat bills, 1906; requiring use of buckshot in killing deer, 1907; authorizing governor to proclaim close season in time of drought, 1909; resident licenses, 1909; deer season reopened, 1910; search without warrant, 1910.

Meadowlark (see Lark).

Memorials, Benevolent Protective Order of Elks, to discourage hunting elk, 1907; Wyoming Legislature requesting Congress to create winter refuges for big game, and Idaho to create game refuge, Wyoming, 1909.

Methods of hunting prohibited (see Hunting).

Michigan, first game law, 1859; punt or swivel guns, first protection nongame birds, 1865; uniform season, 1869; wild pigeons, 1869; protecting elk 10 years, 1879; fish and game warden department with salaried warden, at $1,200, 1887; special deer season Upper Peninsula, killing in water, traps, etc., artificial light, dogs, 1887; international fish and game conference in Detroit, Dec. 20–21, 1891; prohibiting training dogs on game birds in close season, 1891; license system, 1895; limit on deer, 1895; antisale law, 1895; committee on uniform legislation in adjoining States, 1897; prohibition of use of steam or naphtha boats, batteries, pneumatic boats, deadfalls, baited hooks, chemicals, and explosives, 1897; general antisale law, 1901; penalty for careless shooting, 1903; fire protection made duty of State warden, 1907; repeal of act providing penalty for careless shooting of human beings, 1911.

Migratory birds, bag limits, snipe and woodcock, Iowa, 1878.
  Close seasons, woodcock, New York, 1791; snipe, Massachusetts, 1818; ducks, Rhode Island, 1846; upland plover, Rhode Island, 1846; plover and curlew, Massachusetts, 1849; goose and swan, Nevada, 1861.
  Close terms, swan, Wyoming, 1899; woodcock, Oregon, 1901; wood duck, Louisiana, 1904.
  Federal protection, Shiras bill, 1904; Weeks bill, 1908.
Millinery expert, Missouri, 1910.
Millinery provisions, New Jersey, 1885; Wisconsin, 1887; California, 1895; Massachusetts, 1897, 1898.
Militia, captains to read game law to their companies, South Carolina, 1789; Mississippi, 1803; Florida, 1828.
Minnesota, Sunday hunting prohibited, 1849; first game law, 1858; permission required to enter upon growing crops, 1864; setting trap or spring guns, 1869; export, 1871; publication of game law in April annually, 1871; game warden, 1887; prohibiting hunting in standing grain, 1887; minors under 14 prohibited use of firearms, 1889; board of fish and game commissioners, 1891; decision in State *v.* Rodman, 1894 (possession in close season); nonresident license, 1895; resident license, 1899; decision in State *v.* Poole, 1904 (large fine); caribou removed from game list, 1905; hunting accidents due to careless handling of firearms, 1905; storage of game, 1905; shooting within 3 miles of limits of cities of 50,000, 1907; game refuges, 1909.
Minors, prohibited to use firearms, Minnesota, 1889; New York, 1905; half bag limit, Illinois, 1909.
Mississippi, first game law (fire hunting), 1803; county boards of police to regulate preservation of game, 1856; county supervisors to regulate protection of game, 1871; A. O. U. "model law," 1904; general game law, 1906; decision in State *v.* Hill (county ordinance), 1910.
Missouri, first game law, 1851; decision in State *v.* Randolph, 1876 (sale of imported game); nonresidents prohibited from selling game, 1877; nonresidents prohibited from hunting, 1879; game and fish warden, 1895; decision in Haggerty *v.* St. Louis Ice Mfg. Co., 1898 (storage); nonexport law, 1901; general game law, including A. O. U. law, and prohibition of sale or export, 1905; regular deputy wardens abolished, 1907; comprehensive law, 1909; millinery expert appointed, 1910; State game farm, 1910.
Model law for protection of nongame birds (see A. O. U. "model law" and Nongame birds).
Montana, first game law, 1870; sale of all protected game prohibited, 1897; board of game and fish commissioners replaced by warden, 1901; uniform season, 1905; sale of Pablo herd of buffalo, 1907; State game preserves, 1911.
"More Game" movement, inaugurated by Amateur Sportsman, 1908.
Motor boats (see Launches).
Moose, close season, Maine, 1830; last in Adirondacks, New York, 1861; close term 5 years, 3 counties Long Island, New York, 1869; Maine, 1878–80.
Moose refuge, Fire Island, Alaska, 1909.
Mountain goat, close season, Nevada, 1861.
Mountain sheep, close season, Nevada, 1861; close term, Cal., 1883; Utah, 1886.
Mount Olympus National Monument, Washington, established 1909.
Mount Rainier National Park, Washington, established 1899.
Muskrat, close season, Vermont, 1797–1801, 1812–29; New Hampshire, 1821; Ohio, 1830.
National Association of Audubon Societies organized, 1902; incorporated, 1905.
National Association of Game and Fish Wardens organized, 1902; convention, New Orleans, 1910.
National bird reservation, first, Pelican Island, Fla., 1903; act prohibiting trespass on, 1906; 26 reservations established, 1909.
National bison range, Montana, appropriation, 1908; transfer buffalo, 1909.
National game preserves, Wichita, Oklahoma, 1905; Grand Canyon, Arizona, 1906.
National military parks, act prohibiting trespass, 1897.
National military reservation (Fort Niobrara, Nebr.), a game refuge, 1908.
National monument, Mount Olympus, Wash., 1909.
National parks, Yellowstone, Wyo., 1872 (protection of game, 1894); General Grant, Cal., 1890; Sequoia, Cal., 1890; Yosemite, Cal., 1890; Mount Rainier, Wash., 1899; Glacier, Mont., 1910.
Nebraska, first game law, 1860; constitutional provision prohibiting local game laws, 1872; general revision of game law establishing game commission, licenses, and declaring game the property of the State, 1901; decision in McConnell *v.* McKillip, 1904 (confiscation of guns); Fort Niobrara Military Reservation practically made a game refuge by order prohibiting hunting thereon, 1908.
Nests protected (game birds), Connecticut, 1842; (nongame birds) Connecticut, 1850, Vermont, 1851; Pennsylvania, 1858; Kentucky, 1861.
Nets for capturing game prohibited, Wisconsin, 1887.
Netting quail and prairie chickens prohibited, Indiana, 1867.
Nevada, first game law, 1861; game laws to be read in public schools, 1901; board of supervisors authorized to change seasons, 1903.
New Hampshire (first game law, 1741; appointment of two persons to enforce deer law and search for deer unlawfully in possession, 1741); protecting deer, 1778; towns of Newmarket, Stratham, and Exeter authorized to appoint 3 fish wardens, 1809; close season on deer, 1816; on beaver, mink, muskrat, and otter, 1821; decision in Aldrich *v.* Wright, 1873 (fur-bearing animals); board of fish and game commissioners, 1878; establishment of Corbin herd of buffalo, 1890; requiring use of buckshot in killing deer, 1907.

New Jersey (hunting privilege, 1678; close season on deer, 1722); Sunday hunting prohibited, 1798; incorporation of fowling and fishing association, 1813; first protection for rabbits and game birds, 1820; decision in case of Chew *v.* Thompson, 1827 (trespass with guns); landowners authorized to arrest nonresidents hunting on their lands, 1837; law extending close seasons for woodcock, partridge, moorfowl, grouse, quail, and rabbits, 1838; general revision of game laws, 1846; protection of "small and harmless birds," 1850; prohibiting open-water shooting, 1852; 5-year close term on deer in three counties, 1853; night shooting on Barnegat Bay, etc., prohibited, 1859; close term on prairie fowl, 5 years, 1866; close term on ruffed grouse, 3 years, 1869; West Jersey Game Protective Association, 1873; revision of game law and first protection of squirrels, 1874; incorporation of Central Association for propagation and protection of game, 1874; act authorizing formation of game protective associations, 1879; wildfowl shooting on Barnegat Bay, 1879; protecting nongame birds used for millinery purposes, 1885; decision in Allen *v.* Wyckoff, 1886 (nonresident licenses); division of State into districts, 1888, 1908; jurisdiction of commission of fisheries extended to game, 1894; spring shooting prohibited in northern counties, 1908; veto of bill exempting warden service from civil-service law, 1910; plumage law, 1911.

New Mexico, first game law, uniform season for all game, 1880; sale of game killed in Territory prohibited, 1897; game and fish warden, 1903; license system, 1909.

New York (hunting privilege, 1629; first game law, deer, 1705; upland game birds, 1708); close seasons for deer and heath hens, 1785; prohibition of purchase or sale of quail, partridge, woodcock in close season (4 counties), 1837; prohibition of use of batteries, 1839; deer law, 1844; organization of New York Association for the Protection of Game, 1844; last record of wild turkey, 1844; county supervisors authorized to make ordinances for protection of fish and game, 1849 (in effect January 1, 1850); return to general law, 1859; general law, sale of game birds in close season prohibited, wild pigeons and nongame birds protected, trespassing prohibited, 1862; first license law in United States (never in force), 1864; Fish, Game and Forest League, 1865; big guns, 1866; revision of game laws, 1867; proof of killing game outside State defense for possession or sale in close season, 1867; last great pigeon nesting, 1868; hunting deer with dogs, close season deer and moose (3 counties), 5 years, prairie fowl 10 years, swivel guns, 1869; sailing, wildfowl shooting from boats propelled by sail or steam, posted lands, 1869; exemption of imported game except quail, grouse, and venison, 1869; codification of game laws, 1871; county supervisors authorized to pass ordinances to protect birds, fish, and game, 1871; game constable, 1871; publication of the game laws in pamphlet form, 1873; decision in Phelps *v.* Racey, 1875 (sale of imported game); last great pigeon roost, 1875; limit on deer, crusting, hounding in part, 1886; first A. O. U. "model law," with definition of game birds, 1886; sailing for wildfowl or shooting from steamboats 1886; Boone and Crockett Club organized, 1887; chief game and fish protector, 1888; international fish and game conference, October 12, 1891; commissioner of fisheries replaced by forest, fish, and game commission, 1895; New York Zoological Society, 1895; prohibition of jacking deer and shooting them in water, 1897–1902; decision in People *v.* Buffalo Fish Co., 1900 (imported fish); moose and elk for Adirondacks, 1901; provisions declaring law applicable to imported game, and regulating possession of game under bond, 1902; spring shooting of waterfowl prohibited, 1903; shorebirds, 1904; close season for black bear, 1904; restocking Adirondacks with elk and moose, 1904; American Bison Society, 1905; firearms, sale or gift to persons under 16, and carrying by aliens in public, 1905; spring shooting bill defeated, 1906; bills protecting gray squirrels and appropriating $20,000 for buffalo in Adirondacks vetoed, 1907; decision in New York ex rel Hesterberg *v.* People, 1908 (sale of imported game); codification of game law, 1908; authorizing governor to prohibit hunting in forest preserve counties during droughts, 1909; decision in Dieterich *v.* Fargo, 1909 (deer from private preserves); Shea plumage bill, 1910; close season for three years for deer on Long Island, 1910; repeal of November "buck law," 1910; Bayne bill, 1911; conservation commission, 1911; Shea plumage law in effect, 1911.

Night shooting (waterfowl) prohibited, Virginia, 1832; New Jersey (Barnegat Bay, etc.), 1859; North Carolina, 1869; (shore birds), Massachusetts, 1835; discharge of firearms on highway prohibited, Georgia, 1883.

Nonexport law, Kansas, 1876; Florida, 1893; Missouri, 1901.

Nongame birds, Connecticut, 1850; New Jersey, 1850; Vermont, 1851; Massachusetts, 1855; first comprehensive law, Kentucky, 1861; New York, 1862; Michigan, 1865; West Virginia, 1869; protected, Maine, 1870; Indiana, 1873; Kansas, 1876; killing for millinery purposes, New Jersey, 1885; Wisconsin, 1887; A. O. U. "model law," New York, 1886; Florida, 1901; Kentucky, 1902; North Carolina, 1903; Tennessee, 1903; Texas, 1903; Virginia, 1903; Louisiana, 1904; Ohio, 1904; Missouri, 1905; Alabama, 1907; West Virginia, 1907.

Nonresident license, Florida, 1875; Michigan, 1895; Minnesota, 1895; North Dakota, 1895; Wyoming, 1895; Alabama, 1907; Texas, 1907.

Nonresident license law sustained, New Jersey, 1886.

Nonresidents (South Carolina, 1755); arrest by landowners, New Jersey, 1837; prohibited from killing birds on Delaware Bay and River and tributaries, Delaware, 1839; Virginia, 1841; North Carolina (Currituck County), 1854; noncitizens prohibited from hunting deer in

three counties, Pennsylvania, 1840; required to obtain $10 license to hunt or trap in Arkansas, 1875; prohibited from hunting game for sale or export, Missouri, 1877; required to obtain $50 license to net pigeons, Pennsylvania, 1878; prohibited from hunting in State, Missouri, 1879; prohibited from shooting afloat in Currituck Sound, N. C., 1897; prohibited from hunting in Louisiana, 1902; permitted to hunt under license, Louisiana, 1904.

North Carolina (close season on deer, 1738); fire hunting prohibited, 1777, 1779, 1784; nonresidents prohibited from killing wildfowl in Currituck County, 1854; fire hunting wildfowl prohibited in 6 counties, 1869; big guns, batteries, blinds, Currituck Sound, 1870; gamekeepers, Currituck County, 1891; rifles prohibited on Core Sound, 1893; wildfowl, Currituck County, 1897; local legislation (extreme), 1897; gamekeepers, use of decoys and ring shooting boobies on Currituck Sound, 1899; written permission laws in 12 counties, 1899; killing deer illegally a felony in parts of Mitchell County, 1901; A. O. U. "model law," 1903; Audubon Society incorporated with powers of a game commission, 1903; killing deer in water prohibited, 1905; maximum number local laws, 1909.

North Dakota, first game law, 1875; licenses, 1895; State game warden, 1895; district wardens, 1903; prohibiting spring shooting and use of silencers, 1909; game preserves, 1911; prohibiting use of automobiles or rifles in shooting wildfowl, 1911.

Officers of other states authorized to arrest game law violators in Indiana, 1899.

Ohio, Sunday hunting prohibited, 1805; close season on muskrats, 1830; close season on game, 1857; Society for Protection of Game and Fish, 1871; Cuvier Club, 1874; commission of fish and game, 1886; Licking Reservoir a public park, 1894; decision in Roth *v.* State, 1894 (sale of imported game); codification of game law, shorebirds on game list, shooting quail and doves on the ground, search without warrant, 1904.

Oklahoma, first game law, 1890; game and fish warden, 1899; Wichita game refuge established, 1905; instruction concerning birds, 1905; decision in Rupert *v.* United States, 1910 (Lacey Act).

Open seasons, definition, Peables *v.* Hannaford, Maine, 1841.

Open-water shooting prohibited, New Jersey, 1852; batteries or blinds in Currituck Sound, N. C., 1870.

Opossum, close season, Georgia, 1897.

Ordinances (town by-laws), Connecticut, 1833; county, New York, 1849 and 1871; Kansas, 1861; Mississippi, 1871; Louisiana (parish), 1896; California, 1897.

Oregon, first game law, 1872; prohibiting killing deer or elk for hides, horns, or hams, 1874; first importation ring-necked pheasants, 1881; close season on pheasants 5 years, 1882; game and fish protector, 1893; memorial to Congress to protect eggs of wildfowl in Alaska, 1895; snow hunting, 1898; sale prohibited, 1905; season defined by days of week, veto of bill allowing fruit growers to destroy birds, 1907; game commission, 1911; game refuges, 1911.

Overseers of poor to sue for penalties under the deer law, New York, 1820.

Owl protected, New Jersey, 1850; Kentucky (screech owl), 1861.

Owner of dog killing deer in close season guilty of violating law, New York, 1844.

Pablo herd of buffalo sold to Canadian Government 1907.

Packages of game to be marked to show contents, etc., Colorado, 1899; Wisconsin, 1899; Lacey Act, 1900.

Partridge in New England and New York (see Ruffed grouse).

Partridge in the South (see Quail).

Partridge (close season, New York, 1708); Massachusetts, 1818; New Jersey, 1820.

Park, national, see National park.

Park, State, see State parks and game preserves.

Payette River, game refuge, Idaho, 1909.

Pen for catching wild turkeys prohibited, Alabama (3 counties), 1854.

Penalties. Small, for violating Sunday hunting law, 50 cents to $2, Indiana, 1807; large, (for killing elk, $100 to $500, Oregon, 1898; for killing deer, $500, Connecticut, 1905); for shooting human being by mistake for a deer, $1,000 or not more than 10 years imprisonment, Michigan, 1903; repealed, Michigan, 1911.

Pennsylvania, constitutional privilege of hunting, 1776; noncitizens of State prohibited from hunting deer in Monroe County, 1840; close season on squirrels in 5 counties, 1841; hunting deer with dogs prohibited in Jefferson County, 1849; close season, rail and reedbirds, protection insectivorous birds, 1859; close season on squirrels in 11 counties, 1866; trapping, capture of quail for preservation over winter, 1869; 3-year close season for quail (Berks County only), 1870; incorporation Blooming Grove Park Association, 1871; general revision of game law, wild pigeon, nonresident pigeon license, 1878; rest days, 1883; removing protection from English sparrow, 1883; prohibiting spring shooting, 1883; A. O. U. law with definition of game birds, 1889; decision in Comm. *v.* Wilkinson, 1891 (sale of imported game); board of game commissioners, 1895; Audubon Society, 1896; first decision on Lacey Act, United States *v.* Smith, 1902; first alien license law, 1903; game refuges, 1907; prohibiting use of automatic guns in hunting game, 1907; unnaturalized foreign-born residents prohibited from hunting or owning guns or rifles, 1909; decision in Comm. *v.* McComb, sustaining the constitutionality of the automatic gun law, 1910.

Permission required, to hunt on lands of another Feb. 1–Sept. 1, Rhode Island, 1846; to enter upon growing crops, Minnesota, 1864; to hunt on inclosed lands of another, Florida, 1866. Written (see Written permission).

Permits for collecting birds for scientific purposes, Massachusetts, 1870; New York, 1886; Pennsylvania, 1889.

Personal property in game in captivity, Illinois, 1877.

Pheasants, ring-necked, imported into Oregon, 1881; close term, Oregon, 1882.

Photographing big game in winter, license required, Wyoming, 1905.

Pits, for capturing deer prohibited, Michigan, 1887.

Platform, Forest and Stream, antisale, 1894; Hornaday's Sportsman's, 1910.

Plover, close season, Massachusetts, 1835; 1849; no open season (included with insectivorous birds), Vermont, 1851.

Plumage, Florida, 1877; California, 1895; Massachusetts, 1897, 1898; Maryland (seizure of gulls), 1900; Louisiana, 1907 (decision in State *v.* Schwartz); Shea bill, New York, 1910, 1911; New Jersey, 1911.

Pneumatic boats prohibited, Michigan, 1897.

Poachers arrested on Laysan Island, 1909.

Poison (see Drugs).

Police boards (county) to pass ordinances to protect game, Mississippi, 1856.

Police, ducking, Maryland, 1872.

Police juries to pass ordinances to protect game, Louisiana, 1896.

Police officers to enforce game law, New York, 1869.

Possession, person chasing deer in close season deemed in possession thereof, New York, 1844.

Posted lands, trespassing, New York, 1869; District of Columbia, 1878.

Prairie chicken, close season, Wisconsin, 1851; close term (5 years, New York, 1860); 10 years, New York, 1862; 10 years, New York, 1867; 5 years, New Jersey, 1866; 2 years, Colorado, 1867; 6 years, New Jersey, 1874; netting prohibited, Indiana, 1867; bag limits, Iowa, 1878; season opened Illinois, 1911.

Private preserves, Caton preserve, Illinois, 1858; Blooming Grove Park, Pa., 1871.

Privilege, hunting game declared a privilege, Arkansas, 1889.

Publication of game law, reading at head of militia companies, South Carolina, 1789; Mississippi, 1803; Florida, 1828; in newspaper 4 weeks before opening of season, Delaware, 1859; in newspaper at county seat in April, Wisconsin, 1867; Minnesota, 1871; in pamphlet form, New York, 1873; Wisconsin, 1887; summaries issued by United States Department of Agriculture, 1900.

Publications (see Game law publications).

Punt guns (see Big guns).

Quail, close season (New York, 1708); New York, 1791; Massachusetts, 1818; New Jersey, 1820; close term, 2 years, Galveston Island, Tex., 1860; 3 years, Pennsylvania (Berks County), 1870; bobwhite introduced in Utah, 1871, and Idaho, 1875; California Valley, in Washington, 1857; bag limits, Iowa, 1878; European, introduced in New England, 1879; shooting on the ground, Ohio, 1904.

Quail disease (*Colibacillosis tetraonidarum*), 1907.

Quail, netting prohibited, Indiana, 1867; possession for preservation over winter permitted, New York, 1867; Pennsylvania, 1869; sale prohibited, Tennessee, 1911.

Rabbits, close season, New Jersey, 1820; hunting with ferrets (see Ferrets); protection removed, West Virginia, 1911.

Rail protected, Pennsylvania, 1859; Delaware, 1859.

Reedbirds, close season, Pennsylvania, 1859; Delaware, 1859.

Reelfoot Lake fish and game preserve, Tennessee, 1909.

Repeals, protection of muskrat, Vermont, 1801, 1829; game laws of 1729, 1738, 1745, 1766, Tennessee, 1809; act incorporating West Jersey Game Protective Association, 1896; county laws, Alabama, 1907; Tennessee, 1903; Texas, 1903; Virginia, 1903; Massachusetts antispring shooting law of 1870, 1871; Missouri game law of 1905. 1907; Michigan hunting accident law, 1911.

Reservations, bird, Florida, 1903; 26 established, 1909; National Monument, Mount Olympus, Wash., 1909; National Parks, Yellowstone, Wyo., 1872; General Grant, Sequoia, and Yosemite, Cal., 1890; Mount Rainier, Wash., 1899; Glacier, Mont., 1910.

Resident license, Michigan, 1895; North Dakota, 1895; Alabama, 1907; Louisiana, 1908; New York, 1908; Massachusetts, 1909; Texas, 1909; repealed, West Virginia, 1911.

Residents, hunting privileges, Virginia, 1819, 1833; landowners authorized to arrest nonresident hunters, New Jersey, 1837.

Rest days, Susquehanna Flats, Md., 1872; Barnegat Bay, N. J., 1879; Housatonic River, Conn., 1880; Pennsylvania, 1883; Currituck Sound, N. C., 1897; (deer) Massachusetts, 1882.

Revision of game laws, New Jersey, 1846; New York, 1867, 1871, 1908; Pennsylvania, 1878; Michigan, 1901; Georgia, 1903; Maine, 1903; Ohio, 1904; Utah, 1909; Delaware, 1911; Kansas, 1911.

Reynolds, C. B., Book of the Game Laws, 1890.

Rhode Island, first law on game birds, prohibiting spring shooting, shooting on lands of another without permission, Feb. 1 to Sept. 1, 1846; prohibiting use of ferrets or weasels in hunting hares or rabbits, 1860; special constable to enforce game law, 1874; commission on birds, 1899.

Rifles prohibited, Core Sound, N. C., 1893; for shooting water fowl, Illinois, 1911; North Dakota, 1911; for shooting deer, New Jersey, 1909.

Ring shooting boobies on Currituck Sound prohibited Nov. 10 to Feb. 15, North Carolina, 1899.

Robin, close season, Massachusetts, 1818; protection throughout the year, Connecticut, 1850; New Jersey, 1850; Massachusetts (1850), 1855; sale prohibited, Tennessee, 1911.

Ruffed grouse, close season, (New York, 1708); New York, 1791; Massachusetts, 1818; New Jersey, 1820; close term, 3 years, New Jersey, 1869; bag limits, Iowa, 1878.

Sage hen, close season, Nevada, 1861; sale prohibited in close season, Wyoming, 1869.

Sailboats prohibited, New York, 1869, 1886; New Jersey (Barnegat Bay), 1879; Wisconsin, 1887.

Sailing for wildfowl prohibited, New York, 1869, 1886; New Jersey (Barnegat Bay), 1879.

Sailing on Sunday to locate birds for future day, prohibited on Currituck Sound, N. C., 1897.

Salary, State warden, Michigan, $1,200, 1887; $3,000 1907.

Sale prohibited in close season—marsh birds, Massachusetts, 1836; quail, partridge, woodcock, New York, 1837; big game [and game birds], Wyoming, 1869; waterfowl killed in State, Illinois, 1903; imported game, Massachusetts, 1906. Prohibited throughout year—imported or native nongame birds, Massachusetts, 1855; all protected birds (except private sale), Kansas, 1886; (quail, partridge, and woodcock), Michigan, 1895; game killed in Territory, New Mexico, 1897; all protected game, Montana, 1897; Michigan, 1901; Missouri, 1905; Oregon, 1905; Alabama, 1907; robins and quail, Tennessee, 1911.

Salt lick, use for killing deer prohibited (New York, 1871; Pennsylvania, 1873; Vermont, 1896).

Schools, instruction in game preservation and reading of game laws, Nevada, 1901; instruction in habits and protection of birds, Oklahoma, 1905.

Search (constables authorized to search suspected places for red skins of deer, Virginia, 1738).

Search without warrant, Ohio, 1904; Massachusetts, 1910.

Seasons abolished for hunting big game and residents allowed to kill at any time for family use, Wyoming, 1890.

Seasons defined by days of week, Oregon, 1905.

Seasons, uniform, Idaho, 1864; Colorado, 1867; Michigan, 1869; New Mexico, 1880; Montana, 1905; big game, Wyoming, 1882; South Dakota, 1897; game birds (except woodcock), Wisconsin, 1887.

Seizure of big guns, Virginia, 1833; boats, ammunition, and arms used illegally in hunting wildfowl, Virginia, 1842.

Sequoia National Park, California, established 1890.

Shea bill (plumage), New York, 1910; 1911.

Sheriffs, constables, and other police officers to enforce the game law, New York, 1869.

Shipment, restrictions, Iowa, 1874. (See also Export.)

Shiras bill (Federal protection of migratory birds), 1904.

Shooting on lands of another prohibited, West Virginia, 1875; shooting without written permission prohibited, Alabama (9 counties), 1891; North Carolina (12 counties), 1899; within 3 miles of limits of cities of 50,000, Minnesota, 1907.

Shorebirds, spring shooting prohibited, Massachusetts, 1903; on game list, Ohio, 1904.

Shotguns required in killing deer (see Buckshot.)

Silencers prohibited, Maine, 1909; North Dakota, 1909; Washington, 1909.

Silz bill, New York, 1906, 1907.

Sink boxes (see Batteries).

Skiffs, use prohibited in hunting wildfowl in Accomac and Fairfax counties, Va., 1839.

Slaves, to be flogged for hunting on Sunday, New Jersey, 1798; to receive 39 lashes for fire hunting, Mississippi, 1803; prohibited from fire hunting or killing game with firearms without weekly license from master or overseer, Florida, 1828.

Small game protected, West Virginia, 1869.

Smith, G. P., Law of Field Sports, 1886.

Snares prohibited, Alabama (for wild turkey in 3 counties), 1854; Pennsylvania, 1869; West Virginia (rabbits), 1869; Wisconsin, 1887.

Sneak boats licensed on Susquehanna Flats, Md., 1872; prohibited, Wisconsin, 1887.

Snipe, close season, Massachusetts, 1818; Rhode Island, 1846; Alabama (3 counties), 1854; spring shooting prohibited, Rhode Island, 1846; Massachusetts, 1870; bag limit, Iowa, 1878.

Snow hunting prohibited, Delaware, 1887; Oregon, 1898.

Society for Protection of Game and Fish, Ohio, 1871.

Song birds (see Nongame birds.)

South Carolina (nonresidents, 1755; close season on deer, fire hunting, 1769); fire hunting prohibited, 1785–1788; close season on deer, 1789 protection of insectivorous birds and turkey buzzard, 1872; county game wardens, 1905 Audubon Society incorporated, 1907; chief game warden, 1910.

South Dakota, first game law, 1875; nonresident prohibited from hunting big game, every fifth year closed, uniform open season, 1897 (repealed, 1899); nonresidents hunting big game must have guide who is a deputy game warden, 1901.

Sparrow (see English sparrow).

Spears, setting for deer prohibited, New York, 1803.

Sportsman's platform, published by W. T. Hornaday, 1910.

Spring guns prohibited, Minnesota, 1869; Wisconsin, 1887.

Spring shooting bills defeated, New York, 1906; Massachusetts, New York, North Dakota, Wisconsin, 1911.

Spring shooting prohibited, Rhode Island, 1846; Michigan, 1859, 1869; New York, 1860; Massachusetts, 1870; West Virginia, 1875, Pennsylvania, 1883; Wisconsin, 1887; Wisconsin (conditionally), 1893; New York, 1903; Montana, 1905; New Jersey (part), 1908. (See p. 10.)

Squirrels, first close season, Pennsylvania, 5 counties, 1841; New Jersey, 1874; bill protecting throughout the year vetoed, New York, 1907.

State Fish, Game, and Forest League organized, New York, 1865.

State game and fish commissioner, Alabama, 1907.

State game fund abolished, Illinois, 1911; merged in general fund, Wisconsin, 1911.

State game preserve (see Game preserve).

State game warden (see Warden).

State park, Ohio (Licking Reservoir), 1894.

Steam, boats propelled by, prohibited for capturing game, New York, 1869; New Jersey, (Barnegat Bay), 1879; New York, 1886; Wisconsin, 1887.

Storage of game, decision, Missouri, 1898; under bond, New York, 1902; prohibited, Minnesota, 1905; Washington, 1909.

Stuckenbruck bill (meadowlark), California, 1909.

Sulphur, not to be used in smoking out rabbits, Connecticut, 1897.

Summer shooting (woodcock) prohibited, Ohio, 1857.

Sunday, hunting prohibited, Delaware, 1750, 1795; New Jersey, 1798; Tennessee, 1741, 1803; Alabama and Mississippi, 1803; Ohio, 1805; Indiana, 1807, 1817; Illinois, 1821; Minnesota, 1849; Arkansas, 1855; Iowa, 1855; Florida, 1859; sailing to locate birds, North Carolina, 1897.

Suspension of law by county supervisors, Kansas, 1861.

Suspension of open season, Vermont, 1908; Massachusetts, 1909.

Suydam, Charles, Fur, Fin, and Feather, 1868.

Swan, close season, Nevada, 1861.

Swivel guns (see Big guns).

Tagging game, New York, 1911.

Tame deer exempt, New Hampshire, 1816.

Tariff Act, 1894, provision prohibiting entry of eggs of game birds. (Compare Egg Act, 1902.)

Teller bill, Congress, 1897.

Tennessee, Sunday hunting prohibited, 1741, 1803; salaries of State officers paid in skins, 1787; game laws of 1729, 1738, 1745, 1766, repealed 1809; constitutional provision authorizing local legislation, 1870; A. O. U. law, game law, State warden, 1903; department of game, fish, and forestry, 1905; attempt to depose State warden, 1909; Reelfoot Lake fish and game preserve, 1909; sale of robins and quail prohibited, 1911.

Territorial game and fish warden (see Warden).

Texas, first game law (local), 1860; killing of last buffalo, 1889; general game law including A. O. U. law; repeal of county laws, 1903; jurisdiction fish and oyster commissioner extended to game, 1907; nonresident license, 1907; resident license, 1909; public game preserve, 1911.

Training dogs on game birds in close season, prohibited, Michigan, 1891.

Trapping, Wisconsin (game birds), 1854; nonresident license, Arkansas, 1875.

Traps (for deer) prohibited, New York, 1803; Michigan, 1887; (for game), Wisconsin, 1887.

Trespass, decision in case of Chew *v.* Thompson, New Jersey, 1827 (trespass with guns); in growing crops, Minnesota, 1864; on grounds surrounding dwelling, New York, 1862, 1867; on posted lands, New York, 1869; on posted lands, District of Columbia, 1878; hunting on highways prohibited, Kansas, 1886; hunting in standing grain prohibited, Minnesota, 1887; on bird reservations, 1906.

Turkey buzzards protected, South Carolina, 1872; Kansas, 1876; District of Columbia, 1878; Virginia, 1879.

Turkey pens prohibited (Perry County, Pennsylvania, 1840), 3 counties, Alabama, 1854.

Tusk hunters convicted, Wyoming, 1907.

Tusk hunting a felony, Wyoming, 1907.

Uniform action in preventing spring shooting, Wisconsin, 1893.

Uniform open seasons, Idaho, July 1 to Feb. 1, 1864; Colorado, Aug. 15 to Jan, 1, 1867; Michigan, Sept. 1 to Jan. 1, 1869; Alabama, Sept. 1 to Mar. 1 (Mobile County only), 1871; New Mexico, Sept. 1 to May 1, 1880; Montana, Sept. 1 to Dec. 1, 1905; big game, Wyoming, Oct. 1 to 31, 1882; South Dakota, Oct. 1 to Nov. 30, 1897; game birds (except woodcock), Wisconsin, Sept. 1 to Dec. 1, 1887.

Uniformity in State legislation, committee appointed, Michigan, 1897.

Unnaturalized foreign-born residents prohibited from hunting or owning guns or rifles, Pennsylvania, 1909.

Upland plover, close season, Rhode Island, 1846.

Upper Peninsula, special season for deer, Michigan, 1887.

Utah, first game law, 1872; fish and game warden, 1897; codification of game law, 1909.

Vermont (close season on deer, 1779); close season on muskrats, 1797–1801, 1812–29; protecting nongame birds, 1851; fish and game league, 1890; fish commission reorganized as fish and game commission, 1892; fund contributed for paying claims on account of damage by deer to crops, 1902; governor authorized to suspend hunting season, 1908; reopening of doe season, 1909; doe law restored, 1911; appraisal of deer on lands inclosed for parks, 1911.

Vetoes, Act of Congress protecting buffalo, 1874; establishing bird day and a game commission, California, 1907; New York, protecting gray squirrels throughout the year, 1907; appropriating $20,000 for a buffalo herd in the Adirondack Park, New York, 1907; allowing fruit growers to destroy birds injuring their crops, Oregon, 1907; game bill exempting warden service from civil-service law, New Jersey, 1910.

Virginia (close season for deer, 1699); close term for deer, 1772–1776; prohibiting fire hunting, 1792; close season for deer, 1801; law granting hunting privileges to owners of shores, 1819; shortening open season for deer, 1830; protecting wildfowl by prohibiting night hunting or use of big guns, 1832; exempting residents from certain penalties in Act of 1832, 1833; exempting residents from provision requiring warrants for seizure of big guns, 1834; prohibiting use of skiffs in hunting wildfowl in Accomac and Fairfax counties, 1839; prohibiting nonresidents from killing wildfowl below head of tide water, 1841; amending Act of 1841 by authorizing officers to seize boats, tackle, ammunition and arms used in hunting wildfowl illegally, 1842; running deer with dogs in close season, 1856; decision in McCready *v.* Virginia, 1877; act protecting buzzards, 1879; nongame birds, 1903.

Wardens (first local, Massachusetts, 1739; deer reeves, Massachusetts, 1764); fish wardens, New Hampshire, 1809; moose wardens, Maine, 1852; game constable, New York, 1871; game warden (town), Connecticut, 1883; game warden (State), Minnesota, 1887; fish and game warden department, with first salaried warden Michigan, 1887; game warden, Wisconsin, 1887; chief fish and game protector, New York, 1888; special constable, Wyoming, 1890; game and fish protector, Oregon, 1893; game and fish warden, Missouri, 1895; West Virginia, 1897; New Mexico, 1903; fish and game warden, Iowa, 1897; Utah, 1897; Idaho, 1899; State warden, Tennessee, 1903; wardens, Georgia, 1903; South Carolina, 1907; Alaska, 1908; game warden made fire warden, Michigan, 1907; chief game warden, South Carolina, 1910; office under supervision of University, Kansas, 1911 (see also Commissioners).

Warden as guide, South Dakota, 1901.

Ward-McIlhenny Game Preserve, Louisiana, 1911.

Warrant, arrest without, by members of Central Association, New Jersey, 1874; search without, Massachusetts, 1904; Ohio, 1904.

Washington, first game law, 1865; game warden, 1890; hounding prohibited throughout State, 1890; establishment of Mount Rainier National Park, 1899; Mount Olympus National Monument, 1909; silencers, 1909; aliens not permitted to own guns except under license and consular certificate, 1911.

Waste of game prohibited, Wyoming, 1871, 1882; Colorado, 1872.

Water, killing deer in, prohibited, Michigan, 1887; Wisconsin, 1897; North Carolina, 1905; shooting wildfowl in open water prohibited, New Jersey, 1852; using batteries or blinds in North Carolina (Currituck Sound), 1870; Wisconsin, 1887.

Waterfowl protected, Indiana, 1879; Delaware, 1885.

Weasels, use prohibited in hunting rabbits, Rhode Island, 1860.

Weeks bill (migratory birds), 1908.

West Jersey Game Protective Association incorporated, New Jersey, 1873; act repealed, 1896.

West Virginia, first game law, 1868; first comprehensive nongame bird law, 1869; shooting on land of another near occupied dwelling prohibited, 1875; spring shooting prohibited, 1875; game and fish warden, 1897; A. O. U. "model law," 1907; repeal of resident license and removal of protection on rabbits, 1911.

Wichita game refuge, Oklahoma, established, 1905; appropriation for fencing, 1906; transfer of buffalo, 1907.

Wildfowl, first protection, Virginia, 1832, 1833; night shooting prohibited, Virginia, 1832; New Jersey, 1859, North Carolina, 1869; use of skiffs in hunting prohibited, Virginia, 1839; nonresidents prohibited from killing, Delaware, 1839; Virginia, 1841, 1842; close season (ducks) California, 1852; prohibition of sale of killed in the State, Illinois, 1903; sailing for, prohibited, New York, 1886;

Wild goose, close season, Ohio, 1857; Nevada, 1861.

Wild hogs, hunting without notice, Alabama, 1856.

Wild pigeon, netters protected, Massachusetts, 1848; last nesting, New York, 1868; last roosting, New York, 1875; nesting and roosting grounds protected, New York, 1862, 1867; Michigan, 1869; Pennsylvania, 1878; open season, Massachusetts, 1870.

Wild turkey (first close season New York, 1708); last record in New York, 1844; close season, St. Louis County, Mo. 1851; Alabama (3 counties), 1854; snaring or catching in pens prohibited, Alabama (3 counties), 1854; baiting and blinds prohibited, Pennsylvania, 1869; close term 6 years, New Jersey, 1874; introduced in California, 1908.

Wisconsin, first game laws, 1851; prohibiting trapping game birds, 1854; publication of game laws, 1867; prohibiting spring shooting, prohibiting killing birds for millinery purposes, authorization of 4 game wardens, and publication of fish and game laws in pamphlet form, 1887; State game warden, 1891; prohibiting spring shooting conditional on action of other States, 1893; nonresident licenses, 1897; killing deer in the water or on the ice, 1897; marking packages of fish and game, 1899; civil-service law, 1905; first oral examinations for game wardens, 1909; license fees to be paid into general fund of State, 1911.

Woodcock, close season, New York, 1791; Massachusetts, 1818; New Jersey, 1820; summer shooting prohibited, Rhode Island, 1846; Ohio, 1857; bag limit, Iowa, 1878; close term, Louisiana, 1904; Illinois, 1911.

Wood duck, close term, Louisiana, 1904.

Written permission to hunt, Alabama (9 counties), 1891; Indiana, 1891; North Carolina (12 counties), 1899; decision in Hyde *v.* State, Alabama, 1908.

Wyoming, first game law (sale), 1869; uniform open season for big game and prohibition of waste, 1882; close seasons, buffalo and other big game, 1890; special [game] constables, 1890; nonresident licenses, 1895; jurisdiction of fish commissioner extended to game, 1895; guide license, 1899; State game preserve, 1905; license for photographing big game, 1905; incursion of Indians from Colorado, 1906; Yellowstone tusk hunters convicted, 1907; tusk hunting made a felony, 1907; appropriation for feeding big game, 1909; transfer of 25 elk from Jackson Hole to Big Horn Game Preserve, 1910; game commission, 1911; appropriation for feeding elk, 1911.

Yards, killing deer when yarded prohibited, New York, 1886.

Yellowstone National Park, Wyo., established, 1872; act protecting game, 1894; tusk hunters convicted, 1907.

Yosemite National Park, Cal., established, 1890.

Young deer protected. (See Fawns.)

Issued May 21, 1912.

U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 42
HENRY W. HENSHAW, *Chief*

REPORT
OF AN
EXPEDITION TO LAYSAN ISLAND IN 1911

UNDER THE JOINT AUSPICES OF THE UNITED STATES
DEPARTMENT OF AGRICULTURE AND
THE UNIVERSITY OF IOWA

BY

HOMER R. DILL
Assistant Professor of Zoology in the State University of Iowa

AND

WM. ALANSON BRYAN
Professor of Zoology in the College of Hawaii

WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., January 11, 1912.

Sir: I have the honor to transmit herewith for publication Bulletin 42 of the Biological Survey, "A Report of an Expedition to Laysan Island in 1911," in two parts, the first by Prof. Homer R. Dill, of the State University of Iowa, and the second by Prof. Wm. Alanson Bryan, of the College of Hawaii, Honolulu. Prof. Bryan had previously visited the island in 1903 and was thus able to note the changes which had occurred during the intervening eight years. The Hawaiian Islands Reservation was established by Executive order in 1909 to serve as a refuge and breeding place for the millions of sea birds and waders that from time immemorial have resorted there yearly to raise their young or to rest while migrating. In 1909 a party of feather hunters landed on Laysan, one of the twelve islands comprising the reservation, and killed more than 200,000 birds, notably albatrosses, for millinery purposes. Through the prompt cooperation of the Secretary of the Treasury, the revenue cutter *Thetis*, under the command of Capt. W. V. E. Jacobs, was dispatched to the island and returned to Honolulu in January, 1910, with 23 poachers and their booty, consisting of the plumage of more than a quarter of a million birds. In the spring of 1911 a cooperative arrangement was effected with the University of Iowa, represented by Prof. C. C. Nutting, head of the zoological department, whereby an expedition was sent to Laysan, the largest and most important island of the group, to ascertain the present condition of the bird rookeries and to collect a series of birds for a museum exhibit. Through the cooperation of the Secretary of the Treasury and the Commandant of the Revenue Cutter Service the revenue cutter *Thetis* was placed at the disposal of the party. The members were transported from Honolulu to the island in April, and two months later returned to Honolulu. Through the courtesy of the Secretary of War transportation was also furnished on Army transports for members of the party and their equipage between San Francisco and Honolulu. Without this assistance it would have been extremely difficult to arrange for the transportation of the expedition.

The present report embodying the results of the observations made by the party contains many interesting facts and gives an approximate census of the birds nesting on Laysan Island at the time of the visit of the party, together with recommendations for the future protection of the reservation.

Respectfully,

HENRY W. HENSHAW,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

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REPORT OF AN EXPEDITION TO LAYSAN ISLAND IN 1911 UNDER THE JOINT AUSPICES OF THE UNITED STATES DEPARTMENT OF AGRICULTURE AND THE UNIVERSITY OF IOWA.

PART I.

REPORT ON CONDITIONS ON THE HAWAIIAN BIRD RESERVATION WITH LIST OF THE BIRDS FOUND ON LAYSAN.

By Homer R. Dill,
Professor of Zoology in the State University of Iowa.

INTRODUCTION.

PURPOSE AND MEMBERS OF THE EXPEDITION.

On February 3, 1909, President Roosevelt issued an Executive order to the effect that the islets and reefs, namely: ''Cure Island, Pearl and Hermes Reef, Lysianski or Pell Island, Laysan Island, Mary Reef, Dowsetts Reef, Gardiner Island, Two Brothers Reef, French Frigate Shoal, Necker Island, Frost Shoal, and Bird Island, situated in the Pacific Ocean at and near the extreme western extension of the Hawaiian Archipelago, * * * are hereby reserved and set apart * * * as a preserve and breeding ground for native birds. * * * This reservation to be known as the Hawaiian Islands Reservation.''

The purpose of the reservation was to insure for all time a refuge and breeding place for the numerous species of birds, chiefly sea fowl, that for ages past had made the islands their home during the whole or a part of each year. In the spring of 1909, however, a party of foreign plumage hunters landed on Laysan, the principal bird rookery of the reservation, and for several months made the slaughter of sea birds a business. Had they not been interrupted, they would probably have exterminated the entire colony of birds on this island and perhaps on others of the group. As it was, many thousands of sea birds were destroyed, especially albatrosses. There is, however, no reason to doubt that, if left to themselves as much as possible and if further depredations can be prevented, the birds will in time repair this loss and continue to live as they have for thousands of years before civilized man intruded on their beautiful avian world.

Through the instrumentality of Prof. C. C. Nutting, head of the department of zoology, State University of Iowa, arrangements were made in 1911 with the Secretary of Agriculture to send a cooperative expedition to Laysan. The principal objects of the expedition were to obtain for the Bureau of Biological Survey of the department data for a comprehensive report as to the present condition of the rookeries and as to the effects of the nefarious work of poachers on the avifauna and to make a collection of the birds, their nests, eggs, and the necessary accessories for making a large panoramic group for the State University of Iowa.

The personnel of the party consisted of the writer and three assistants, Mr. H. C. Young, Mr. C. J. Albrecht, and Mr. C. A. Corwin. Mr. W. A. Bryan joined the party in Honolulu as the representative of the Department of Agriculture, spent a week on Laysan, and returned to Honolulu on the *Thetis*.

The writer is indebted to Mr. E. M. Ehrhorn, Mr. D. B. Kuhns, Mr. Max Schlemmer, Mr. W. A. Bryan, the members of the University Club, and others for their kind assistance and hospitality while in Honolulu. I wish also to acknowledge the invaluable assistance of the men who accompanied me: Mr. H. C. Young, who assisted in assembling data for this report, Mr. C. J. Albrecht, who made the photographs, and Mr. C. A. Corwin, who made paintings for our group. I am also indebted to Mr. Dayton Stoner, of our museum staff, for his careful drawing of the map on which I have indicated the bird rookeries.

HAWAIIAN ISLANDS RESERVATION.

The Hawaiian Islands Reservation is composed of the islands and reefs included in the leeward chain extending in a northwesterly direction from the main Hawaiian Group. These islands are situated from 100 to 300 miles apart and are composed principally of lava. Laysan, the largest island of the reservation, is low and flat, the highest point being only 50 feet above sea level. On the surface of this island is a layer of coral sand and phosphate rock. Laysan has an area of about 2 square miles; the others vary in size from 1 square mile to small rocky reefs. Bird Island is high and precipitous, having a peak of 903 feet, and one side of the island is perpendicular.

These islands have a vegetation of low bushes and sand grasses. The climate is warm but not enervating, tempered as it is by the northeast trade winds. Severe thunder storms are almost unknown.

At the present time the islands are entirely uninhabited by man, and indeed landing can be effected only in favorable weather; but they offer excellent nesting sites and abundant food for the millions of sea birds which resort to this remote oceanic reservation.

WATER AND NATURAL FOOD SUPPLY.

Frequent but short showers supplied us with plenty of drinking water. I have recorded them as follows: April 24, April 27, May 2, May 3, May 14, and June 2. We carried a small still for use in case our water supply failed us, but did not have occasion to use it, although our supply was reduced at times. There is an old well on the island, but it is no longer of use. The pump is rusted out and the well has partly filled with sand.

Plenty of good fish can be found in the still water between the surrounding barrier reef and the shore, and they can easily be shot with a good rifle. Crawfish also are obtainable and are easily caught in the evening by using a small lantern and a spear.

Large turtles are found along the beaches, where they crawl out to sun themselves. When turned on their backs they are helpless. We killed one of these turtles and found the meat very good, but the eggs we did not find palatable. This turtle was 4 feet long, 3 feet wide, and 1 foot 5 inches from carapace to plastron. We estimated her weight to be 300 pounds.

The rabbits are good for food and their flesh seems to be entirely free from parasites. When not frightened they may be easily caught in the hands.

Although there were many edible shore birds on the island, our party did not kill any of them for food. The only birds eaten were those collected for scientific purposes.

SEALS.

A little-known species of seal[1] is reported to live in the region of Laysan Island. Mr. Max Schlemmer says that during the 15 years he lived on the island seven of these animals were killed. He at one time gave Dr. Schauinsland a fine large skull of this species, which was taken to Germany. No signs of seals were noted while we were on the island, notwithstanding a sharp lookout was kept by the members of our party.

RABBITS INTRODUCED ON LAYSAN.

Mr. Max Schlemmer, the former manager of the guano company on Laysan, introduced domestic rabbits, Belgian hares, and English hares into the island at different times, and left them there to breed, intending to start a rabbit canning business. He could not give the exact dates but thinks the first were imported eight or nine years ago, or about 1903. The rabbits have crossed and produced some strange-looking animals, both in form and color. We dressed some of them for food and found the skins as tough and thick as that of the groundhog.

---

[1] This species has been described by Dr. Matschie as *Monachus schauinslandi* (Sitz. Ber. Ges. Naturf. Freunde, Berlin, p. 254, 1905). In 1900 a sick or helpless seal was caught by the natives in Hilo Bay, Hawaii, towed ashore, killed, and eaten. Unfortunately I was too late to secure any part of the animal for identification, but the natives assured me that solitary seals occurred on the coast about once in 10 years or so. They were very curious and asked many questions as to the habitat of the animal, its nature, food, and habits, about which they knew nothing.—H. W. Henshaw.

Rabbits have killed many bushes, but have not caused so great devastation as one would expect from their numbers. In the latter part of the afternoon they may be seen feeding. They are very fond of the green juncus that grows near the lagoon, and, while they are eating, their bodies are concealed among the thick growth and only their ears show. At times there are so many ears protruding that they resemble a vegetable garden.

It would be very difficult to exterminate these animals without harming the birds. They live everywhere; even in the large tern rookeries we saw many of them. They have made burrows of their own and also, when pursued, take refuge in the numerous petrel burrows. It is impossible to drive or snare them, as there are plenty of holes in which they can find shelter. Poisoning the rabbits would be disastrous to certain species of birds and indiscriminate shooting would also be harmful. It is my opinion that a well-organized party with small repeating rifles, say 22 caliber, could entirely exterminate these pests. This should be done in the season when it would interfere least with the nesting birds.

The man-o'-war birds catch them. Several times we saw them pick up full-grown rabbits, and we found young ones dead on the nest of the red-footed booby.

GUINEA PIGS.

Guinea pigs were found on the south end of the island in the thick juncus. They were rather abundant in this one place, seven being seen at one time, but they have done no harm. Mr. Schlemmer introduced these animals.

INSECT PESTS.

The collector is not without his troubles on Laysan. Never have I seen so many flies in one small area. Our laboratory was so full of them that we were obliged to suspend work to reduce their numbers. Shallow pans of formalin, about 2 per cent, did wonders in this direction. Not only did the flies annoy us as we worked but they would blow our bird skins, and even after the latter were thoroughly dry and cured, we often found fresh masses of eggs deposited on the feathers. The feet of the larger birds would be eaten by larvæ if they were not thoroughly poisoned.

In addition to the flies there were small ants which ate and destroyed the feathers of the smaller specimens. There were also several species of beetles, the larvæ of which devoured everything that was not well poisoned.

Plenty of netting is needed to keep flies away from the skins while drying. Rough frames should be made and their legs immersed in pans of water, in order that boxes of skins may be placed in safety from the ants. The beetles are, however, harder to control, for they seem to reach the skins notwithstanding the netting. If the skins show signs of larvæ, put them in a tight box with a good cover. In the top of the box place a shallow pan of carbon bisulphide, using about one tablespoonful of the fluid for every cubic foot of space. Cover the box tightly, allowing it to remain 48 hours. The carbon bisulphide should be put in the top of the box, since the gas settles. This should be repeated in about seven days, so as to kill the larvæ that may have hatched in the meantime. Where pests are so prevalent, I recommend treating each box of skins in this manner as they are packed for shipment.

The acres of carcasses left by the poachers have furnished breeding places for flies and beetles; hence their great numbers.

BIRDS AS SEED CARRIERS.

Mr. H. W. Henshaw, Chief of the Biological Survey, requested that our party make careful observation as to the presence of seeds or balls of earth attached to any portion of the bills, feet, or plumage of the island birds, since there is reason to believe that birds play an important part in the transplantation of seeds from shore to shore.

In handling and preparing 400 specimens we found but one that was of interest in this connection. On the foot of a Laysan albatross, between the second and third toes, was a spinate seed about the size of a flattened buckshot, the spines of which were firmly embedded in the sides of the toes. The seed was sent to Washington, where it was identified as the seed of *Tribulus hystrix* R. Br. This species belongs to the family *Zygophyllaceæ* and is generally distributed in the South Sea Islands. So far as known there is no record of its occurrence on Laysan, but a thorough examination of the flora might reveal its presence there.

NARRATIVE.

The 17th day of April, 1911, our party sailed from Honolulu on the revenue cutter *Thetis*. During the first five days of our trip few birds were seen except a number of black-footed albatrosses (*Diomedea nigripes*) that followed the ship nearly all the way. When within about 50 miles of Laysan, their numbers increased, and later they were joined by one or two of the white species (*D. immutabilis*), also by a few sooty terns (*Sterna fuliginosa*) and wedge-tailed shearwaters (*Puffinus cuneatus*).

About 11 o'clock of the seventh day the island was sighted. We expected to see clouds of birds about it, but in this we were disappointed. It was too early for terns to arrive in large numbers. We reached the shore about 3 o'clock and spent the remainder of the day in landing our outfit and repairing the old building for our use. (Pl. I.) By 6 o'clock everything was beached and the *Thetis* sailed to Midway Island, coming back a week later for our mail and to say farewell until the 5th of June, when she returned for our party.

Our first impression of Laysan was that the poachers had stripped the place of bird life. An area of over 300 acres on each side of the buildings was apparently abandoned. Only the shearwaters moaning in their burrows, the little wingless rail skulking from one grass tussock to another, and the saucy finch remained. It is an excellent example of what Prof. Nutting calls the survival of the inconspicuous.

Here on every side are bones bleaching in the sun, showing where the poachers have piled the bodies of the birds as they stripped them of wings and feathers. In the old open guano shed (Pl. II) were seen the remains of hundreds and possibly thousands of wings which were placed there but never cured for shipping, as the marauders were interrupted in their work.

An old cistern back of one of the buildings tells a story of cruelty that surpasses anything else done by these heartless, sanguinary pirates, not excepting the practice of cutting the wings from living birds and leaving them to die of hemorrhage. In this dry cistern the living birds were kept by hundreds to slowly starve to death. In this way the fatty tissue lying next to the skin was used up, and the skin was left quite free from grease, so that it required little or no cleaning during preparation.

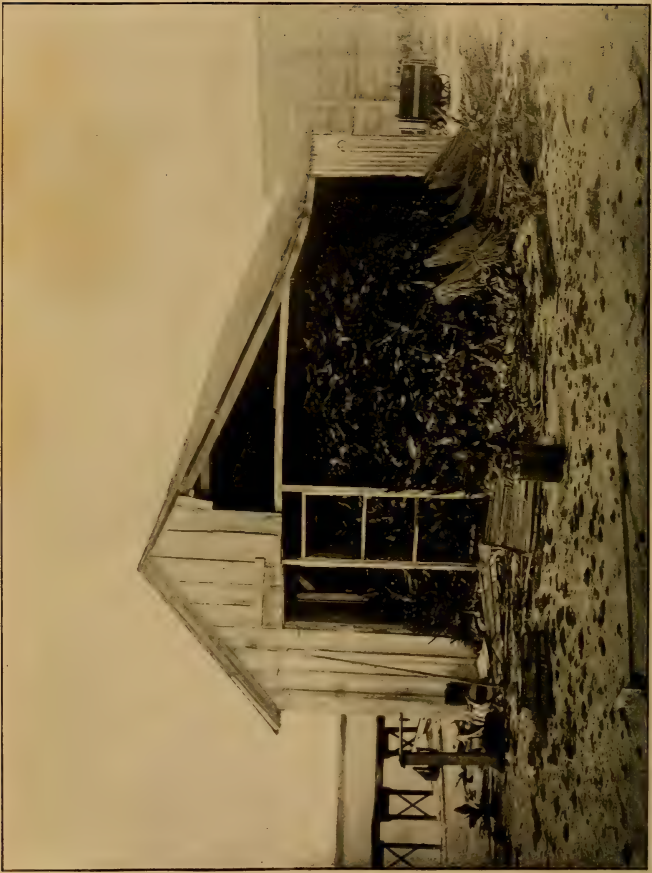
Many other revolting sights, such as the remains of young birds that had been left to starve and birds with broken legs and deformed beaks, were to be seen. Killing clubs, nets, and other implements used by these marauders were lying all about. Hundreds of boxes to be used in shipping the bird skins were packed in an old building. It was very evident they intended to carry on their slaughter as long as the birds lasted.

Not only did they kill and skin the larger species but they caught and caged the finch, honey eater, and miller bird. Cages and material for making them were found.

Half an hour's walk, however, will take one to an entirely different scene. The north, east, and south parts of the island have not been disturbed to any extent by the poachers, they having confined their work largely to the area nearer the buildings and along the car track formerly used by the guano company.

We found some species on the east side even more abundant than reported by Prof. Nutting in 1902. It is interesting to note the

BUILDINGS ON LAYSAN ISLAND.



Albatross Wings Piled in Old Guano Shed, Laysan Island.

habits of the gregarious little creatures. For countless generations they have lived in a crowded community, like the inhabitants of our larger cities, and now, although the killing of thousands of birds on the west side of the island has made nesting places available elsewhere, they still live as did their predecessors, nesting as closely as possible.

In collecting birds that had young, much care was exercised not to take both parents and thus to leave the nestlings to perish. This made the collecting of some species difficult and slow. Fortunately we were able to preserve and so utilize many birds that were found dead on the rookeries, the mortality from natural causes being large.

LIST OF BIRDS ON LAYSAN.

It is not my intention to attempt to duplicate the excellent report on the birds of Laysan Island by Dr. Walter K. Fisher[1] in 1902, to which readers are referred for many details here omitted. We found the same species that he did, with the addition of Bulwer's petrel and the sooty petrel (*Oceanodroma tristrami*). The following is a list of the island birds, with notes on their distribution, habits, nests and eggs, etc., as observed by our party:

LARIDÆ.

Sterna fuliginosa Gmelin. Sooty-backed Tern.

Upon our arrival at Laysan we did not observe many sooty-backed terns. There was a small colony of about 500 birds on the southwest part of the island and another of about the same size on the extreme east. We found great piles of bones near the former that led us to believe that the birds had been much reduced in numbers by the plumage hunters.

About the 6th of May thousands of them appeared on the east side of the island and about a week later others came to the southwest. Their numbers increased each day. As the southwest rookery grew, it extended toward the north. For some reason known only to themselves the birds confined their nesting to the area on the west side of the small car track, which is indicated on the accompanying map. We found a few nests between the rails, but none on the east side of the track. The first day of June we measured the rookeries of these birds, and two days later we went over the same ground again. We found that in two days the rookeries on the west side had increased in area 3,600 square yards.

The final estimate of the number of sooty terns was made June 4—333,900 for both rookeries. This species outnumbers any other on the island. We found as many as 7 and in some cases 9 nests to the

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[1] Birds of Laysan and the Leeward Islands, Hawaiian Group, in U. S. Fish Commission Bulletin for 1903.

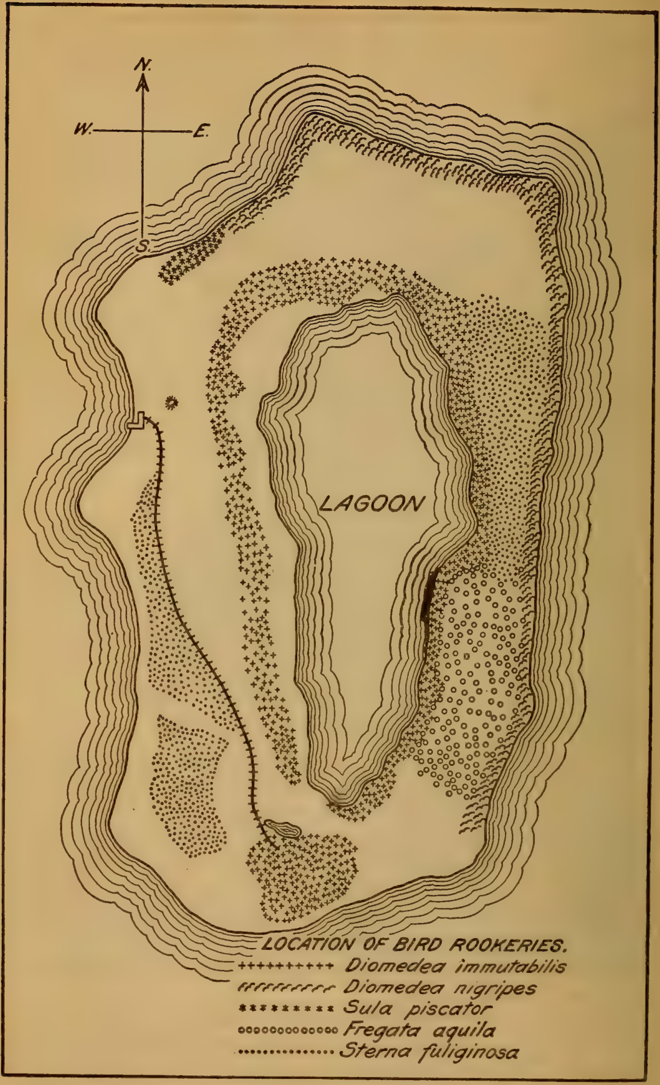

N.
W.
E.
S.
LAGOON
LOCATION OF BIRD ROOKERIES.
++++++++++ Diomedea immutabilis
ʳʳʳʳʳʳʳʳʳʳ Diomedea nigripes
✱✱✱✱✱✱✱✱✱ Sula piscator
ooooooooooooo Fregata aquila
.... Sterna fuliginosa

FIG. 1.—Map of Laysan Island.

square yard of ground. About 1 nest in 50 contained two eggs, one egg being the usual complement.

Sterna lunata Peale. Gray-backed Tern.

On the rocks at the south end of the island is a small colony of gray-backed terns. Its close proximity to the sooty tern rookery might mislead the casual observer as to the number of birds of this species. As soon as the birds are disturbed the sooty terns fly about with the graybacks, giving the impression that there are thousands of the latter. The unfortunate grayback makes a desirable skin for millinery purposes; hence his demise.

There are other small rookeries on the east side, and we estimated that about 50,000 of these birds were nesting on the island. We found fresh eggs and young birds in all stages of development.

Anous stolidus (Linn.). Noddy.

Noddies were nesting in small colonies on nearly all parts of the island. The northwest point seemed to be a favorite nesting place, and during the last week of May fresh eggs were found. The noddy is fairly abundant, numbering about 5,500.

Micranous hawaiiensis Rothschild. Hawaiian Tern. (Pl. III.)

This little understudy of the noddy was found in all stages, from a freshly laid egg to a fully fledged bird. It was not so abundant as the noddy, numbering about 3,000.

Gygis alba kittlitzi Hartert. White Tern or Love Bird.

During the first week of our stay in Laysan we saw but four white terns (Pl. IV, fig. 1). This little bird, never abundant on the island, was one of the first to disappear at the hands of the poachers.

About the time the sooty terns arrived in abundance we noticed a number of white terns. On the 15th of May we discovered several pairs nesting on the rocks at the south end and later found others on different parts of the island. At one time we were able to count 30 of these birds.

We collected six specimens, all of which, although nesting, were more or less pin-feathery and unfit for mounting. We estimated the number of this species to be 75.

DIOMEDIIDÆ.

Diomedea immutabilis Rothschild. Laysan Albatross. (Pl. V.)

Along the shores of the lagoon and on a small area at the south end of the island this most remarkable and interesting bird has taken its last stand. To-day there is about one-sixth of the original colony left. All along the car track and on the main rookery where the birds were formerly so abundant, only piles of bones remain. The poachers killed these helpless creatures with clubs and threw the wings and feathers into the cars, heaping the bodies up along the sides of the track as they worked, and used the cars to carry the spoils to the sheds.

About all of the old main rookery, where the birds were reported so plentiful by Prof. Nutting in 1902, has been annihilated; only now and then a pair of birds with young may be seen. Along the shores of the lagoon they are still to be found in large numbers, and to one who has never seen such masses of birds it is a wonderful sight.

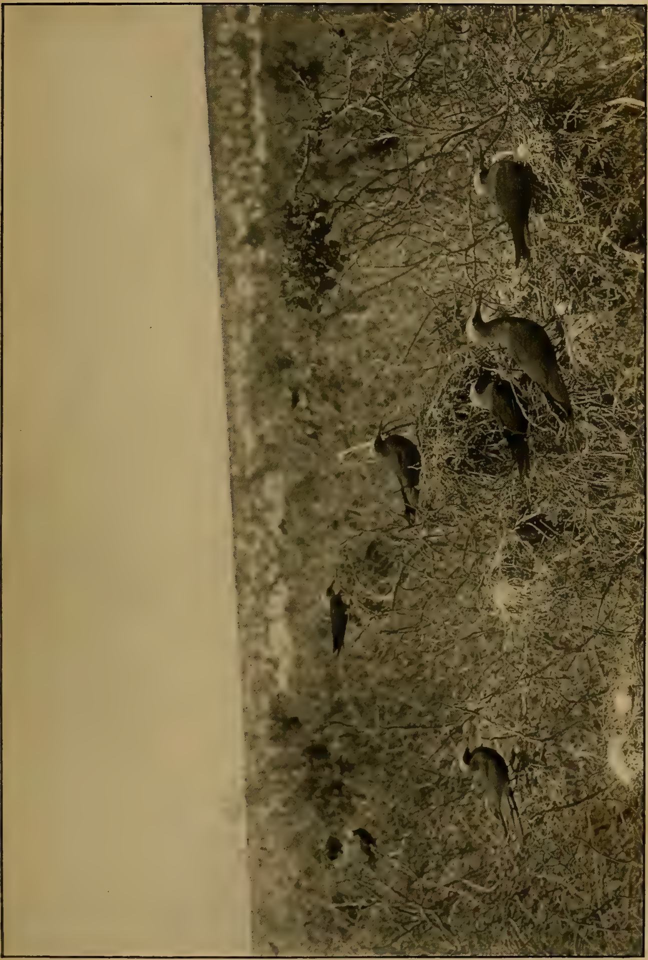
Notwithstanding the treatment these birds have received, they still seem fearless of man, with the exception, perhaps, of a few stray individuals nearer the buildings which will not allow one to approach them.

They amuse themselves with a strange proceeding, which at times seems to be done more from a sense of duty than for pleasure. The performance is varied, but usually begins as follows: One bird approaches another with an indescribable squeaking sound, bowing all the time. If the other bird feels like performing, which is usually the case, he bows in return. They cross bills very rapidly several times. Then one bird turns its head and lifts one wing in such a manner that the primaries point directly out at the side. In the meantime the other bird keeps up a loud noise that sounds somewhat like the neighing of a horse. The bird taking the lead then walks around his partner, stepping high like a negro cakewalker. This part of the procedure is usually closed by one or both birds pointing their beaks straight up in the air, rising on their toes, puffing out their breasts, and uttering a long-drawn groan. The same thing is repeated many times with slight variations.

There were comparatively few young albatrosses. When the parent birds were feeding at sea, the rookery would seem almost deserted. We found a number of young birds dead, but the mortality from natural causes is not large, considering the number of this species. Something must have disturbed the birds earlier in the nesting season; possibly their eggs may have been taken.

An accompanying map (p. 14), on which I have indicated the larger rookeries, will show about the area occupied by this species. At the present time there are approximately 180,000 Laysan albatrosses.

For the benefit of those who have estimated the number of albatrosses as high as 10,000,000, I would like to call attention to the map made by the officers of the *Albatross* in 1902. According to this map Laysan has an area of about 5,420,800 square yards. Taking out the area of the lagoon, which is 471,500 square yards, we have 4,949,300 square yards. Place 10,000,000 birds the size of an albatross upon 4,949,300 square yards of ground; how much room would



NESTING COLONY OF HAWAIIAN TERNS, LAYSAN ISLAND.

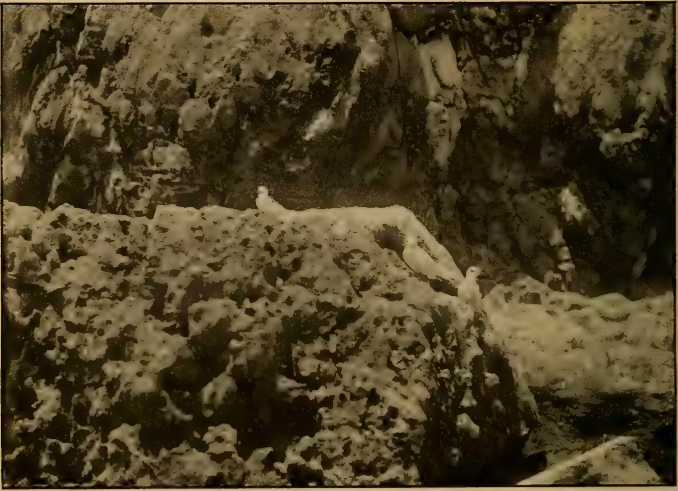


FIG. 1.—WHITE TERNS OR LOVE BIRDS, LAYSAN ISLAND.

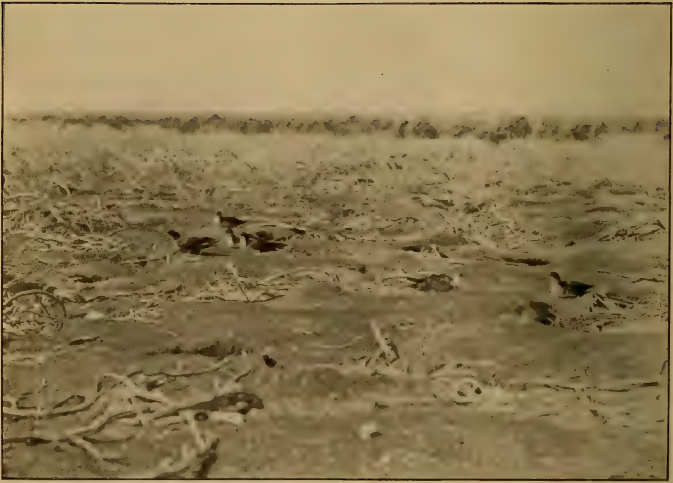
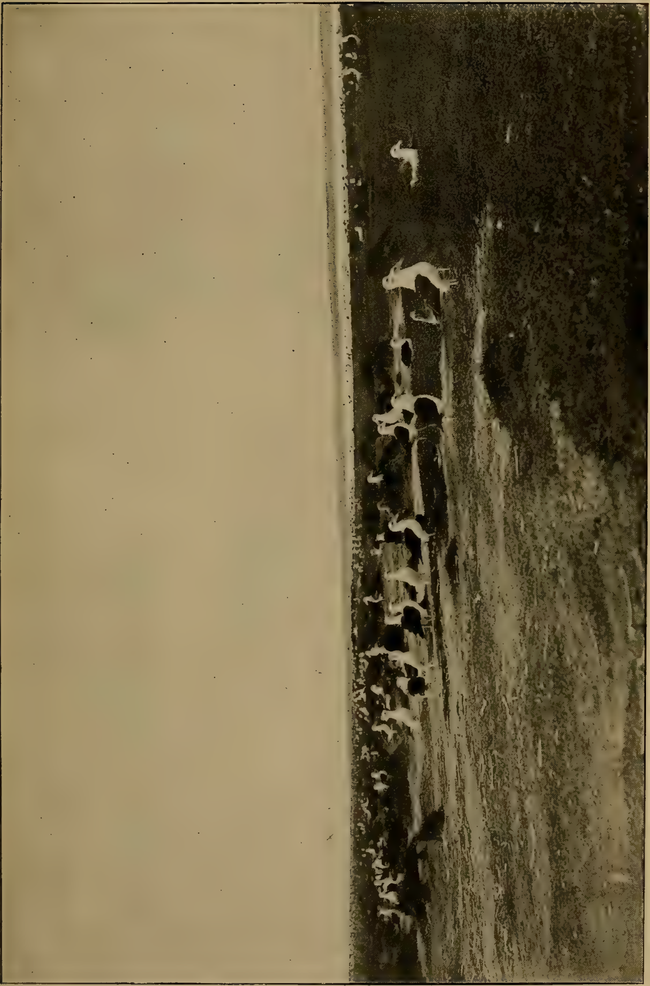


FIG. 2.—COLONY OF WEDGE-TAILED SHEARWATERS, LAYSAN ISLAND.



Laysan Albatross Rookery.

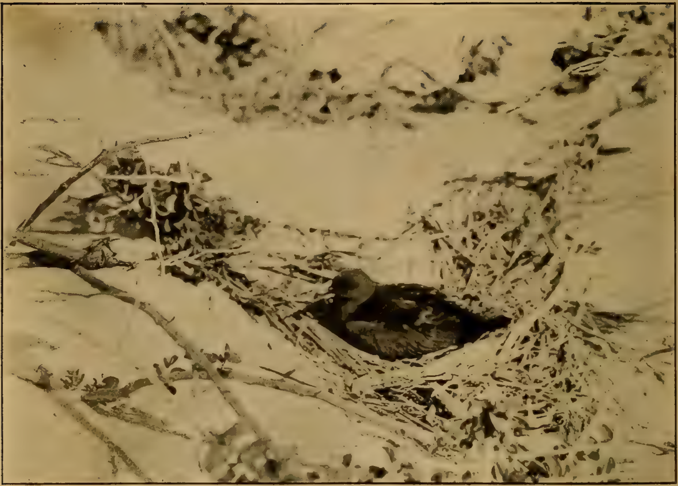


FIG. 1.—CHRISTMAS ISLAND SHEARWATER ON NEST, LAYSAN ISLAND.

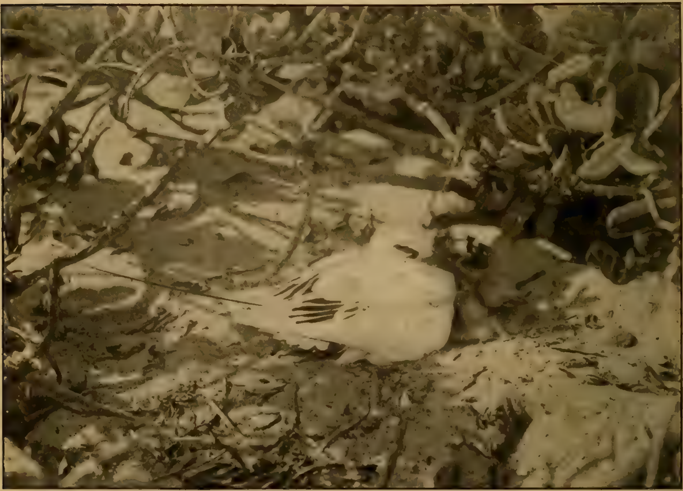


FIG. 2.—RED-TAILED TROPIC BIRD WITH YOUNG, LAYSAN ISLAND.

there remain for the rest of the bird population, to say nothing of the bushes and grass?

Diomedea nigripes Audubon. Black-footed Albatross.

Along the beaches of the north, east, and south sides of the island the black-footed albatross has taken almost complete possession. An occasional pair may be found nesting with the white species, but as a rule they are found by themselves.

The black-footed albatross is somewhat larger than the white species, and when seen on the wing it is instantly recognized as being far superior as an aviator. They followed our ship all the way from San Francisco to the Hawaiian Islands.

These birds have a performance similar to that of the former species, but much more elaborate, and they go through the figures slowly and gracefully. Instead of lifting one wing they raise both. The notes uttered during the performance are much softer, and it ends with a sound like the stroke of a bell under water or deep within the bird's stomach.

They are very neighborly with the other species. We often saw them visiting, and on one or two occasions they were trying to perform with them, but the rapid pace set by the white bird was rather too much for his more deliberate cousin and the affair ended disastrously.

The young of this species were rather abundant. During the first week of June many of them were fully fledged. The total number of black-footed albatrosses is about 85,000.

PROCELLARIDÆ.

Puffinus cuneatus Salvin. Wedge-tailed Shearwater.

The wedge-tailed shearwater (Pl. IV, fig. 2) is found on nearly every part of Laysan, with the exception of the beaches and the hard shores of the central lagoon. It does not fly about much during the day, but sits in the mouth of its burrow and dozes in the sun. At times a dozen or more of these birds congregate, apparently for the purpose of quarreling. Their cat-like squalls will soon make the listener wish to move out of hearing.

The young were nearly fledged. Apparently these birds were not killed to any extent by the poachers and they number about 100,000.

Puffinus nativitatis Streets. Christmas Island Shearwater.

The Christmas Island shearwater (Pl. VI, fig. 1) is a common bird on Laysan. We found it nesting under bushes and in shallow burrows. Its eggs were fresh during the first two weeks of May. Its retiring habits and unattractive plumage have protected it from the ravages of the poachers and it numbers about 75,000.

Æstrelata hypoleuca Salvin. White-breasted Petrel, or Bonin Island Petrel.

Owing to its nocturnal habits the white-breasted petrel is not so conspicuous as some of the other species of its family, but it was abundant in the evening. It is a fearless, dove-like creature, quite amenable to petting and stroking.

The young of this species were nearly fledged. They were to be seen in the mouths of the deep burrows which completely honeycomb the higher ground of the island. This species bids fair to hold its own for some time to come, numbering 160,000.

Bulweria bulweri (J. & S.). Bulwer's Petrel.

In Dr. W. K. Fisher's report of the Birds of Laysan Island, 1902, he states that he did not detect any Bulwer's petrels on Laysan. We were, therefore, somewhat surprised to find this species rather abundant, and at the same time of year that Dr. Fisher was there.

In the cracks and crannies of the rocks on the south end of the island one was sure of finding these birds, and in almost every case a pair of birds would be in the same opening. We found them also on other parts of the island, wherever there were pieces of phosphate rock or coral under which to crawl.

While we were after some specimens of coral rock, we were much surprised to find one of these quiet little birds sitting in the débris that had fallen from the under side as we applied the sledge hammer from above. The pieces had dropped in such a manner that, notwithstanding the falling of a piece weighing 75 pounds or more, the bird was unharmed and apparently not alarmed. Under the bird we found a fresh egg. This incident occurred on the 2d day of June, and although we had previously seen many of these birds, we had not found any eggs. Upon further investigation we found that the birds on the south end of the island had eggs, all of which were fresh. In some nests we found both birds sitting side by side. We estimated the number of this species to be 1,000.

Oceanodroma tristrami Salvin. Sooty Petrel.

The sooty petrel is not a common bird on Laysan. Near the south end of the lagoon a number of young birds were found, all dead or in a dying condition. They were fully fledged, retaining only traces of down. A diligent search procured but two adult birds. These birds were so much smaller than the measurements given by Mr. Ridgway for this species that there was at first some question as to their identity.

The following table gives Mr. Ridgway's measurements, also those of the specimens referred to above:

O. tristrami.

MEASUREMENTS BY MR. RIDGWAY.

Sex.	Date.	Length.	Wing.	Tail.	Fork of tail.	Culmen.	Depth bill front of nostril.	Tarsus.	Mid. tcl.
......	....	Skin; about 11 inches.	7.50	4.45	1.60	0.70	0.25	1.10	1.10

SKINS COLLECTED ON LAYSAN BY OUR PARTY.

♀	Apr. 28	10.00	7.00	4.3	1.50	0.8	0.22	1.02	1.04
♂	May 22	9.8	6.54	4.1	1.20	.8	.20	1.04	1.06
♂	May 29	9.00	5.8	4.16	1.25	.76	.20	.94	1.16

PHAËTHONTIDÆ.

Phaëthon rubricaudus Boddaert. Red-tailed Tropic Bird.

During the first three weeks of our stay on the island we saw very few red-tailed tropic birds (Pl. VI, fig. 2). They were wild and very hard to catch. Later, however, we saw plenty of them, and as they were nesting, we experienced no trouble in catching them in our hands.

This species has by far the most beautiful plumage of any of the birds found here. Its rose-tinted satin body, with bright coral red beak, and its elongated central tail feathers make it a striking bird indeed.

The poachers have killed many of these birds, but they still seem fairly abundant, numbering about 300.

SULIDÆ.

Sula cyanops (Sundevall). Blue-faced Booby.

A small colony of blue-faced boobies (Pl. VII, fig. 1), was nesting on the sandy beach of the east coast. By actual count, 45 birds were there during the first week in May. Large downy young were in the nests, usually one but in some cases two. A few eggs were found, but all were well incubated.

On the 5th day of June we were somewhat surprised to find about twenty pairs of these birds nesting on the interior slope of the east side of the island in close proximity to the man-o'-war bird rookery. Why they should choose such an environment is hard to understand. Nearly all the nests contained two fresh eggs.

Not far from this spot we saw a man-o'-war bird pursuing a booby which had just returned from fishing, with a crop full of fish. At first it seemed as though the booby would outfly its pursuer, but its load was too heavy. The man-o'-war bird overtook the booby, seized it by the tail, raised itself in the air, and turned the booby completely over. Being thus rudely overturned the booby lost control and quickly disgorged the contents of its crop, and the man-o'-war bird actually caught the fish as it came from the booby's mouth.

Sula piscator (Linn.). Red-footed Booby.

The red-footed booby (Pl. VII, fig. 2), like its relative, is not very abundant. They are confined to a small area on the north part of the island, nesting in the tops of low bushes. Their numbers increased about the same time we noted the increase of the former species. There were about 125 birds in all.

FREGATIDÆ.

Fregata aquila (Linn.). Man-o'-war Bird.

On the inner eastern slope of the island the man-o'-war birds (Pl. VIII) may be found. They nest in colonies in the tops of low bushes which, if placed near together, would cover about 6 acres. As it is, however, they appear to cover many times that amount of space.

Here sitting quietly on each nest is the owner thereof, holding down his claim. When one bird leaves the nest its mate immediately takes its place, for if a nest is left unguarded the birds that seem to be off duty swoop down, apparently passing nearly over it, when with a quick movement of the beak they pick up a stick and carry it away. Thus stick by stick the nest is completely removed. If there happens to be a young bird or an egg in the nest, it is destroyed and eaten by the winged cannibals.

One forgets the shortcomings of these birds when he sees them sailing on motionless wing far above him. It would seem that they make use of the hot air currents arising from the island and thus sail about with very little effort.

It seems strange that man-o'-war birds should have increased in numbers, when we think of their wholesale slaughter of each other's offspring, but according to previous reports they were less abundant on Laysan formerly than to-day, numbering 12,500 at the present time.

ANATIDÆ.

Anas laysanensis Rothschild. Laysan Teal.

No signs of the Laysan teal (Pl. IX, fig. 1) were seen for the first few days of our stay, and then we found feathers and other parts of those which the marauders had dressed for food. Later, however, we saw them in small flocks, six being the most seen at one time. Some teals seemed to be nesting in the grass near the small fresh-water pond on the south end of the island, but we were unable to find any nests.

The man-o'-war birds persistently pursued them, but they did not to my knowledge kill or harm any of them. They may, however, kill young teals.

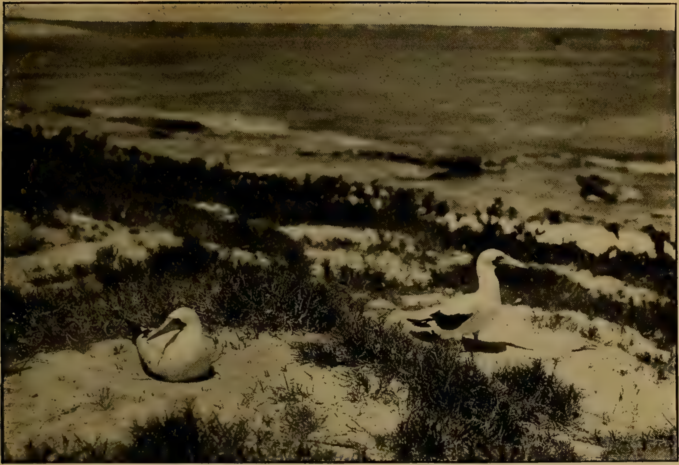


FIG. 1.—BLUE-FACED BOOBY, LAYSAN ISLAND.

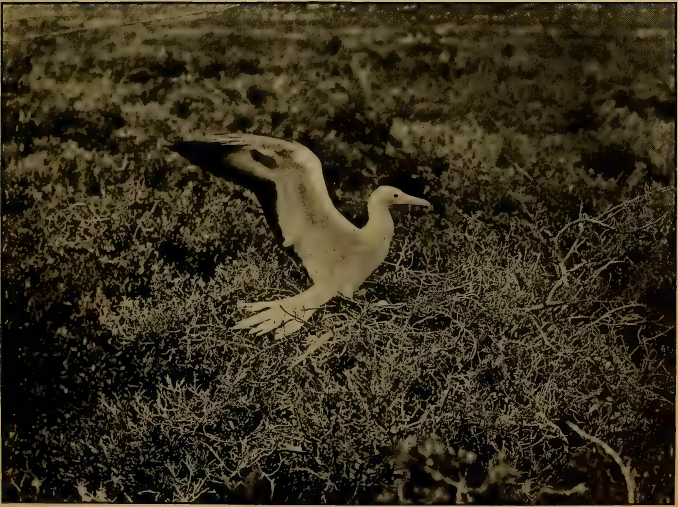
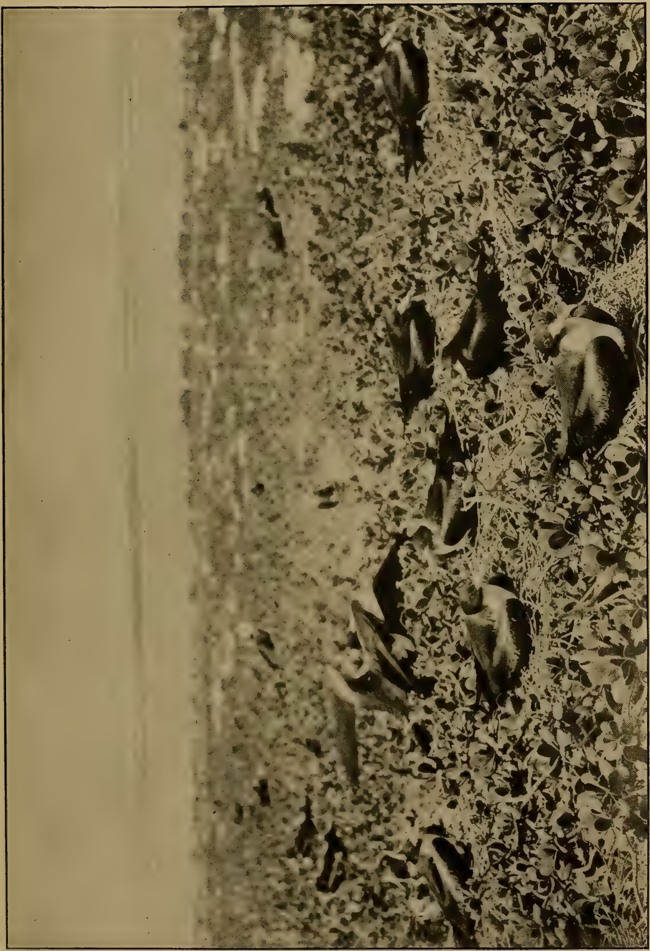


FIG. 2.—RED-FOOTED BOOBY, LAYSAN ISLAND.



MAN-O'-WAR BIRDS ON NESTS, LAYSAN ISLAND.

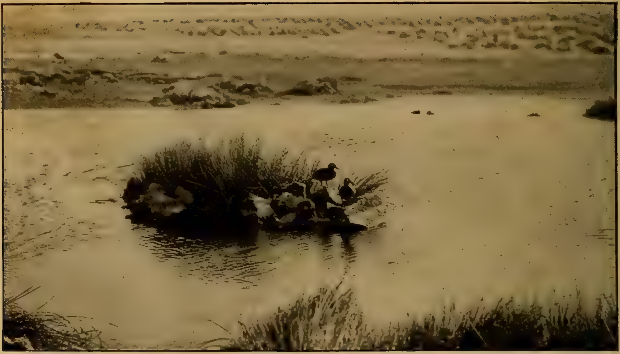


FIG. 1.—LAYSAN TEAL.

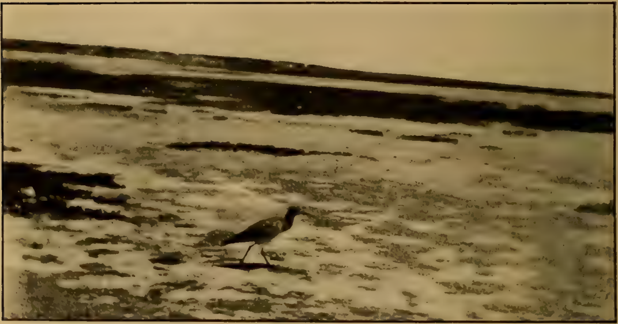


FIG. 2.—BRISTLE-THIGHED CURLEW, LAYSAN ISLAND.

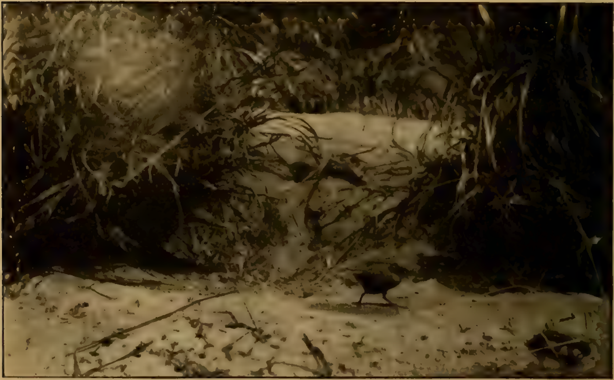


FIG. 3.—LAYSAN RAIL.

Presumably the plumage hunters killed these birds for food, and thus nearly exterminated them. It would seem that without further molestation they might increase in numbers.

RALLIDÆ.

Porzanula palmeri Frowhawk. Laysan Rail.

The Laysan rail (Pl. IX, fig. 3) is one of the most interesting birds found on the island. Notwithstanding its inability to fly it has no trouble in evading its pursuers. It runs and dodges from one grass tussock to another, down a petrel hole and out again before one can locate it. One of the most laughable things imaginable is a man pursuing one of these bits of bird life, net in hand, continually dropping waist-deep down among the burrowing petrels. It was with much difficulty that we secured the specimens we needed for our collection. They were everywhere fairly abundant on all parts of the island excepting the beaches. They even visited our kitchen. Their favorite nesting place is among the thick mats of juncus along the margin of the lagoon. We found many nests but no eggs. On the 4th day of June we discovered two coal-black chicks with yellow beaks that gave vent to much noise. There are about 2,000 rails on the island.

SCOLOPACIDÆ.

Heteractitis incanus (Gmelin). Wandering Tatler.

Very few of these birds were seen on Laysan during our stay. Now and then one or two would be seen on the reef or among the large rocks on the beach, but they were very wild. One specimen only was secured.

Numenius tahitiensis (Gmelin). Bristle-thighed Curlew.

Just before sunset and early in the morning the bristle-thighed curlews (Pl. IX, fig. 2) would come up around our camp uttering their peculiar complaining notes. They roosted on the roofs of the old buildings at night, sometimes as many as 20 birds in one flock. We saw them feeding on different parts of the island but usually about the lagoon or along the beaches. They number about 250.

CHARADRIIDÆ.

Charadrius dominicus fulvus (Gmelin). Pacific Golden Plover.

The golden plover is only a migrant on Laysan. About 2,000 were present at the time of our visit.

APHRIZIDÆ.

Arenaria interpres (Linn.). Turnstone.

In the shallow water of the lagoon and about the fresh water pond, large flocks of plover and turnstones were to be seen. Here they spent most of their time feeding on the small flies with which the shore and water are black.

The specimens we prepared for our collection were exceedingly fat. We experienced some difficulty in securing good ones, as the birds were too wild to catch in a hand net and were easily ruined with a shotgun. The turnstones number about 2,500.

DREPANIDIDÆ.

Himatione fraithii Rothschild. Laysan Honey Eater.

The honey eater is not common on Laysan. There were four birds of this species that roosted on an old rope which hung across the corner in one of the sheds. Here each night we would see them huddled closely together. An occasional bird would flit into our workroom in quest of millers. They were to be seen about the island in the tall tussocks of grass, where we found a few nests, all of which contained young birds or well-incubated eggs. Among the old specimens left by the feather hunters we found several skins of the honey eater. There are possibly 300 living birds of this species.

Telespiza cantans Wilson. Laysan Finch.

One of the last birds to disappear from the island will be the Laysan finch. With its omnivorous habits and its saucy, fearless manner it easily adapts itself to conditions as it finds them. It is a fine songster and makes a good cage bird. Laysan Island is an ideal place for this bird, but should anyone be rash enough to introduce it to a civilized community it would be a pest that would rival the English sparrow.

They were everywhere abundant about the island, particularly near the tern rookeries. When we passed through the rookeries they would follow, to steal the eggs left exposed by the terns we had frightened away. They also eat other birds' eggs, not excepting their own species.

Our cook experienced much difficulty in keeping them from the kitchen. Each day brought more birds. At last he was obliged to put up a net at the door to keep them out. They also visited our storeroom, where they picked holes in our rice bag, making way with quite a quantity. At meal time they were about our feet picking at the crumbs on the floor. It was not an uncommon thing to see them on the table. They were nesting during the month of May, and we found many nests with fresh eggs. We estimated the total number of finches to be about 2,700.

SYLVIIDÆ.

Acrocephalus familiaris (Rothschild). Miller Bird.

With the exception of the Laysan teal, the miller bird is the least abundant of the indigenous birds. We saw a few of them around the old buildings and others about the island, but principally along the west shore of the lagoon, in the tall grass, where a few nests containing eggs and young birds were found.

A pair made a nest not far from our sleeping quarters. The birds seemed not to mind our presence, working away at the nest when we were within 2 feet of it. After it was completed, the female bird died while laying an egg. We saved the skin of the bird, also the egg, which was removed intact. In a few days the male bird returned with a new mate, and, much to our surprise, the birds took down the nest, building a new one a few feet away.

It seems strange that this bird should not be more common, as it was formerly reported to be most abundant of the land birds. Presumably the poachers caught the miller bird, but we have no proof of it, as no skins or other parts were found. Its numbers are kept in check by the finches—at least we saw the latter eating the eggs of this species. Undoubtedly, however, this has been their practice for many years, and, unless the finches are more abundant than formerly, it ought not to make any appreciable difference in the numbers of the miller bird.

ISLAND BIRD CENSUS.

An estimate of the number of each species of bird found on the island was made. The method of estimating the number in the several rookeries was as follows: After carefully measuring a rookery, a square yard was selected that seemed to contain a fair average of nests. Counting two birds to a nest we determined the number in a rookery. In some cases this method could not be used, as some species do not assemble in large numbers but nest in small colonies among the other species. The map (p. 14) accompanying this report is not a criterion as to the number of birds in the various rookeries, but simply shows the location and approximately the area covered by the species indicated thereon. To avoid confusion I have indicated thereon only the birds that have sharply defined rookeries, the others being more or less united.

The following table shows at a glance the estimated numbers of most of the island birds:

Sterna fuliginosa	333, 900	*Sula cyanops*	65
Sterna lunata	50, 000	*Sula piscator*	125
Anous stolidus	5, 500	*Fregata aquila*	12, 500
Micranous hawaiiensis	3, 000	*Anas laysanensis*	6
Gygis alba kittlitzi	75	*Porzanula palmeri*	2, 000
Diomedea immutabilis	180, 000	*Numenius tahitiensis*	250
Diomedea nigripes	85, 000	*Charadrius dominicus fulvus*	2, 000
Puffinus cuneatus	100, 000	*Arenaria interpres*	2, 500
Puffinus nativitatis	75, 000	*Himatione fraithii*	300
Æstrelata hypoleuca	160, 000	*Telespiza cantans*	2, 700
Bulweria bulweri	1, 000		
Oceanodroma tristrami	3		1, 016, 224
Phaëthon rubricaudus	300		

PART II.

REPORT ON CONDITIONS ON LAYSAN, WITH RECOMMENDATIONS FOR PROTECTING THE HAWAIIAN ISLANDS RESERVATION.

By Wm. Alanson Bryan,
Professor of Zoology in the College of Hawaii.

INTRODUCTION.

On the occasion of my recent visit to Laysan Island during the week from April 24 to 30, 1911, which was made on board the U. S. revenue cutter *Thetis*, in company with a party from the State University of Iowa who were making the journey to the island to secure material and background studies for a large group to be assembled at that institution, I was able to study conditions as I found them in this wonderful bird colony and compare them with conditions existing there at the time of my former visit in April, 1903.

The slaughter of tens of thousands of birds by the party of feather and wing hunters and the depredations now being wrought by the rabbits and guinea pigs that have been introduced on the island make it important, if this colony is to be saved from extermination, that every effort to this end be made, both by the Federal Government and by the Territory of Hawaii. It will be necessary (1) to have the islands in the Leeward chain of the Hawaiian group properly patrolled and protected; (2) to take steps to exterminate or reduce the rabbits on Laysan Island; (3) to distribute the peculiar land birds on Laysan to other islands of the chain in order to prevent their early extermination; (4) to introduce the important economic species on the inhabited islands of the group; (5) to plant on Laysan and the other islands certain trees and shrubs that will flourish on them; (6) to develop this valuable possession of the Territory of Hawaii as the great natural parks are developed elsewhere—as a natural breeding preserve for wild birds. Since the birds are all perfectly fearless, the reservation may be visited at any season under proper regulations, thus affording to the Hawaiian Islands a unique opportunity to preserve this great colony in a flourishing condition and at the same time utilize the chain of otherwise unimportant and unproductive islands, over a thousand miles in length, as a cruising and camping park and fishing ground, the like of which is found nowhere else in the world.

Several months ago it became my duty as the representative of the National Association of Audubon Societies in Hawaii to notify that society and the Biological Survey that the island of Laysan of the Leeward chain of this group had been visited by a company of feather hunters. They were under the employ of Mr. Max Schlemmer, now of Honolulu, but who was for many years a resident on Laysan as manager for a large guano and fertilizer concern with headquarters in Honolulu.

After spending several months on the island engaged in the wholesale slaughter of the bird life there, the poachers were taken off by the U. S. revenue cutter *Thetis* under command of Capt. Jacobs, who was sent there by the Federal Government for that purpose. With the 23 poachers who were brought to Honolulu for trial the *Thetis* brought two or three carloads of the feathers, wings, and birdskins that had been made ready for shipment to Japan. Had the plan of the promoters been carried out, they would doubtless have been sent from Japan to the fashion centers of Europe and America for millinery purposes.

COMPARISON OF CONDITIONS IN 1903 AND 1911.

By my experience on Marcus Island and Midway Island a few years ago, where I had the sad privilege at the first-named island of finding a colony of poachers actually engaged in killing birds by the thousands for the millinery market, and at the latter of finding the hundreds of heaps of dead birds' bodies left by a party that had finished securing its ship load of wings and feathers, I was in a measure able to anticipate the damage that had been done by these ruthless spoilers at Laysan.

My surprise was great, however, to find that the few rabbits introduced by Mr. Schlemmer shortly after my former visit had literally taken possession of the island. In 1903 Mr. Schlemmer, then operating a lease and engaged in the guano business, made a number of trips from Honolulu. On a number of these voyages he took several small shipments of rabbits of different breeds as well as a number of Japanese guinea pigs. All of these animals were liberated on Laysan and they have since multiplied until they are found in great numbers at this time.

The slaughter wrought by the plume hunters is everywhere apparent. One of the work buildings formerly used by the guano company and later as a storehouse by the poachers is still standing. With a side torn out and left open to the weather by the men of the *Thetis*, it is still filled with thousands of pairs of albatross wings. Though weatherbeaten and useless, they show how they were cut from the birds whose half-bleached skeletons lie in thousands of heaps scattered all over the island.

This wholesale killing has had an appalling effect on the colony. No one can estimate the thousands, perhaps hundreds of thousands, of birds that have been willfully sacrificed on Laysan to the whim of fashion and the lust for gain. It is conservative to say that fully one-half the number of birds of both species of albatross that were so abundant everywhere in 1903 have been killed. The colonies that remain are in a sadly decimated condition. Often a colony of a dozen or more birds will not have a single young. Over a large part of the island, in some sections a hundred acres in a place, that 10 years ago was thickly inhabited by albatrosses, not a single bird remains, while heaps of the slain lie as mute testimony of the awful slaughter of these beautiful, harmless, and without doubt beneficial inhabitants of the high seas.

While the main activity of the plume hunters was directed against the albatrosses, they were by no means averse to killing anything in the bird line that came in their way. As a consequence large numbers of all the different species of birds that occur on the island were killed. Among the species slaughtered may be mentioned black-footed albatross, Laysan albatross, sooty tern, gray-backed tern, noddy tern, Hawaiian tern, white tern, Bonin Island petrel, wedge-tailed shearwater, Christmas Island shearwater, red-tailed tropic bird, blue-faced booby, red-footed booby, man-o'-war bird, bristle-thighed curlew, and without doubt many of the few species of the smaller birds peculiar to Laysan as well as those that visit it as migrants.

Fortunately, serious as were the depredations of the poachers, their operations were interrupted before any of the species had been completely exterminated. So far as the birds that secure their food from the sea are concerned, it is reasonable to suppose they will increase in number, and that nature will in time restore the island to its former populous condition if no further slaughter is permitted. Owing to the indiscriminate method of the killing, usually only one or the other of mated pairs was sacrified. The unmated birds that survive are slow in selecting another mate. As but a single egg is laid by the majority of these birds, it will possibly take 10 years for the sea birds of the colony to regain their former numerical strength.

With the land birds an entirely different condition exists. All the small species peculiar to the island, except possibly the Laysan teal, depend entirely upon the vegetation on the island for their food supply. The uninterrupted and astonishing increase in the numbers of rabbits and guinea pigs can have but one result if allowed to continue unchecked. They will surely eat or kill off all of the grass and shrubs. Doubtless the insects that feed on the plants and in turn are fed upon by the birds will be so reduced as to bring about starvation among the small birds.

The struggle for existence on Laysan is most keen at all times. The inevitable operation of the law of nature that balances the food supply with the number to be fed is as effective on this sand island as it is everywhere else in the world. As a matter of fact, a marked reduction in the number of pairs of all the land birds can be noticed as compared with the number of the same species on the island eight years ago. The Laysan canary, Miller bird, Laysan honey eater, and the Laysan rail, without doubt, are doomed to extermination on the isolated island on which they have maintained themselves long enough to develop into distinct species, unless something is done to preserve for them the source of their food supply.

Rare as the Laysan teal has always been, it is gratifying to find that it has not been wiped out of existence. Eight years ago there were several small flocks of this interesting bird, which is without doubt the rarest wild duck in the world. This year only seven adult birds were seen during an entire day especially devoted to watching for it on the small fresh-water lake and the main lagoon—the natural rallying place for the species. Ducks were seen on five of the seven days spent on shore, but there were by no means as many of them as there were on the occasion of my former visit. One pair seen had a flock of five young following them. Thus it will be seen that while this rare species is not extinct, as was greatly feared, it is so rare that there are probably not more than a half dozen adult pairs on the island at this time.

Even after the wholesale slaughter of the birds and the result it had on their nesting and mating habits, the birds remain as fearless as ever. There is not a species on Laysan that can not be caught in the hands with a little care and patience. One pair of ducks, for example, came up within 6 feet of the writer, a lack of fear which would make the species an easy one to exterminate should poachers at any time make another raid on the island inhabitants.

Rabbits now literally swarm over the island by thousands. The amount of damage done by them can better be imagined than told. They are exterminating first one species of plant then another. Several species that were common everywhere eight years ago have entirely gone, others are already doomed. Unless some drastic measures are resorted to within a very short time not a bush or spear of grass will be alive.

There is no indication that the islands of Laysan and Lysianski have been visited by hunting vessels since the last visit of the *Thetis*. It is to be hoped that for the time being at least the traffic in birds' wings and feathers has been broken up in these waters. However, there is no assurance that it will not be renewed without notice, hence the necessity for continuing the service of the *Thetis* or a similar vessel, and the necessity of making frequent visits at irregular intervals to all of the islands of the reservation.

RECOMMENDATIONS FOR FUTURE PROTECTION OF THE RESERVATION.

As to the future care of this wonderful colony, I would suggest that the most effective way to conserve the bird life is to appoint a warden for the reservation who should have general supervision of these low-lying islands and their bird inhabitants. A resident warden should then be provided who should be supplied with a small auxiliary power schooner, or a large power sampan, that would enable him to make frequent and unannounced visits at irregular intervals to all of the islands along the chain. The installation of a wireless telegraph station at Midway, where the power and facilities are already available, would add greatly to the convenience and safety of commerce and trans-Pacific travel and would put the islands of the chain in direct touch with Honolulu and the outside world.

If a vessel such as has been suggested should be stationed at Laysan or Midway Island it would be an important step toward the proper supervision of all the outlying islands, whether included in the reservation or not. Naturally the people and the authorities of the Territory of Hawaii feel a keen interest in the welfare of this reservation. A feeling is growing that the day is not far distant when this Territory will look upon the Leeward chain of islands as forming a great natural park as interesting and wonderful in its way and as instructive to visit as are any of the other famous national parks.

The visiting of these islands and reefs by interested persons, should they be opened to the public under proper regulations and supervision, will result in no harm to the breeding colony, as the long residence of the guano company on the island of Laysan has proven. As years go by and the birds become more rare elsewhere, the great reservation thus conserved in the mid-Pacific will be an object of world interest and concern. The birds themselves are a valuable possession to Hawaii and the nation, while as an attraction to visitors as well as to the residents of these islands they represent, as yet, an asset that is scarcely appreciated.

It is urged that the Federal Government and the Territorial government should at once become actively interested in these islands and that measures should be taken to safeguard the birds against the possibility of further despoliation by plume hunters. It is also urged that steps should be taken to introduce the rare land birds of Laysan on other of the low islands of the chain where conditions are favorable in order to prevent the extermination of these interesting and valuable birds in the manner I have suggested.

At least three of the land forms of Laysan are of unquestioned economic importance and of great value to the Territory of Hawaii as the natural enemies of certain noxious and injurious insects. The difficult problem of their transportation and introduction into the inhabited islands should be taken up vigorously and without delay by the Territorial government. One of the main objects of the writer's recent trip to Laysan was in the interest of the Territory and made for the purpose of studying the habits of these birds on the ground with the foregoing practical object in view. The visit just made and the experiments carried on while en route and on the island resulted in working out simple and practical methods of transportation which, it is believed, if followed up, will make it possible to capture and transport living specimens of these delicate insect-eating species for long journeys at sea without serious loss.

ADDITIONAL COPIES of this publication may be procured from the SUPERINTENDENT OF DOCUMENTS, Government Printing Office, Washington, D. C., at 10 cents per copy

Issued January 9, 1913.

U. S. DEPARTMENT OF AGRICULTURE

BIOLOGICAL SURVEY—BULLETIN No. 43

HENRY W. HENSHAW, *Chief*

INDEX TO PAPERS RELATING TO THE FOOD OF BIRDS

BY MEMBERS OF THE BIOLOGICAL SURVEY

IN PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE 1885-1911

BY

W. L. McATEE

Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1913

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., March 13, 1912.

Sir: I have the honor to transmit herewith, for publication as Bulletin No. 43 of the Biological Survey, an index, by W. L. McAtee, to papers on the food and food habits of birds, published up to December 31, 1911, by the Biological Survey of the Department of Agriculture. Since 1885 no fewer than 131 papers relating wholly or in part to the economic status of birds have appeared in the various publications of the department, including Annual Reports, Bulletins, Faunas, Yearbooks, Farmers' Bulletins, and Circulars. These contain more or less extended accounts of 401 species of native birds and 59 foreign or introduced species. The index serves the two very useful purposes: (1) Of showing just what has and what has not been published by the department on the status of birds in the United States; (2) of greatly facilitating reference to the data contained in the reports.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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INDEX TO PAPERS RELATING TO THE FOOD OF BIRDS BY MEMBERS OF THE BIOLOGICAL SURVEY IN PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, 1885-1911.

INTRODUCTION.

The object of this bulletin is to furnish an index to papers by members of the Biological Survey in the various publications of the United States Department of Agriculture up to and including December, 1911, which contain information on the economic status of birds as determined by their food habits. Statements concerning the value of feathers, flesh, eggs, guano, or the use of birds as game are not taken into account, but only notes on bird food or inferences drawn from a consideration of food with definite reference to some species of bird.

The publications indexed are the Bulletins, Circulars, and North American Faunas, published by the Biological Survey, the Annual Reports of its Chief, and the Farmers' Bulletins and Yearbooks, publications of the Department of Agriculture as a whole.

In the 26½ years of its existence, from July 1, 1885, to December 31, 1911, members of the Biological Survey have prepared 131 documents relating wholly or in part to the food of birds. These publications contain notes on the economic status of no fewer than 401 species of native birds and 59 species of foreign or introduced birds. (See table.) In the case of 173 species of native birds and one introduced bird, reports embodying a résumé of printed and communicated testimony concerning the food, together with detailed analyses of stomach contents, have been published. These are the most important statements of the economic value of our birds.

Series of publications.	Number in series.	Number of articles containing economic information.	Number of species of birds receiving economic consideration.			
			Formal reports.		Other notes.	
			Native birds.	Foreign and introduced birds.	Native birds.	Foreign and introduced birds.
Bulletins	40	28	162	1	314	28
Circulars	84	13			157	2
Farmers' bulletins (by members of Biological Survey)	23	8			67	4
Faunas	34	13			118	11
Annual reports	25	37	32		93	15
Yearbooks	17	32	9		221	21
Totals (duplicates deducted)		131	173	1	401	59

ANNOTATED BIBLIOGRAPHY OF PAPERS RELATING TO THE FOOD OF BIRDS.

The first part of this bulletin consists of a bibliography of the publications of the Department of Agriculture that were written by members of the Biological Survey and contain information concerning the food of birds, with brief reviews of the papers. The bibliography is divided into sections, arranged in the following order: Bulletins, Circulars, Farmers' Bulletins, Faunas, Annual Reports, and Yearbooks.

BULLETINS.

BULLETIN 1. The English sparrow (*Passer domesticus*) in North America, especially in its relations to agriculture. By Walter B. Barrows. 405 pp. 1 pl. (frontispiece). 9 figs. 1 colored map [by F. E. L. Beal]. 1889.

This comprehensive publication includes discussion of the introduction of the sparrow, method of diffusion, rate of spread and increase, natural enemies; checks by climate, limits of food supply, and by man; its economic status in Great Britain; injuries to fruits, vegetables, garden seeds, and grain; its relations to other birds and to insects; and an account of miscellaneous injuries. Tables showing the results of analysis of contents of 636 stomachs fill 10 pages. Recommendations for legislation and for private efforts to reduce the numbers of sparrows, a general consideration of bounty laws, and a review of the existing legislation affecting the species are given. The bulletin includes also the following special reports:

- Insectivorous habits of the English sparrow, by C. V. Riley, pp. 111–133.
- Destruction of the sparrow by poison, by Dr. A. K. Fisher, pp. 174–178.
- The trapping of sparrows for sporting purposes, by W. T. Hill, pp. 178–191.
- History of the house sparrow (*Passer domesticus*) and the European tree sparrow (*Passer montanus*) at Saint Louis, Mo., by Otto Widmann, pp. 191–194.

Pages 197–357 present in detail the evidence from correspondence and published sources upon which the foregoing parts of the bulletin are largely based. The quotations refer to experience with the English sparrow in Europe, America, Australia, and New Zealand, and include casual references to the economic value of a number of foreign and native birds. A list of all persons whose testimony appears in the bulletin and an unusually complete index are given.

BULLETIN 2. Report on bird migration in the Mississippi Valley in the years 1884 and 1885. By W. W. Cooke. Edited and revised by Dr. C. Hart Merriam. 313 pp. 1 colored map. 1888.

Includes casual references to the character of the food of 11 species, mostly birds of prey.

BULLETIN 3. The hawks and owls of the United States in their relation to agriculture. By A. K. Fisher, M. D. 210 pp. 26 colored pls. 1893.

The introduction (pp. 9–18) to this bulletin summarizes the food habits of the various species and groups them according to their economic value. Then follows the detailed consideration of the food habits of the species, giving information gleaned from correspondence, published sources, and stomach examination. The results of examinations of 37 species are tabulated. The name "short-winged hawk," given on page 11, is a slip of the pen and should be omitted. The same error occurs in Circular 61, p. 3, 1907; Yearbook 1894, p. 217; 1895, p. 590; 1896, p. 628.

Bulletin 4. The prairie ground squirrels or spermophiles of the Mississippi Valley. By Vernon Bailey. 69 pp. 3 colored pls. 4 colored maps. 1893.

The natural enemies of spermophiles, including nine hawks and six owls, are discussed in pages 15–18.

Bulletin 5. The pocket gophers of the United States. By Vernon Bailey. 47 pp. 6 figs. 1 colored map. 1895.

In the treatment of natural enemies, pp. 20–22, two species of hawks and three of owls are mentioned.

Bulletin 6. The common crow of the United States. 98 pp. 1 pl. 2 figs. 1895.

General habits of the crow. Animal food of the crow. Insect food of the crow. By W. B. Barrows [pp. 9–57 and 68–71, figs. 1–2]. Report on the insect food of the crow. By E. A. Schwarz [pp. 57–67]. Vegetable food of the crow. Protection of crops. By W. B Barrows [pp. 72–94].

Bulletin 6 treats first of the general habits of the crow, including its migrations and the formation of roosts. Next the animal food is discussed, the principal topics being the relations of the crow to rabbits, mice, ground squirrels, gophers, bats, moles, shrews, sheep, swine, eggs and young of poultry and wild birds, and to tortoises, snakes, lizards, frogs, toads, salamanders, fish, crustacea, and mollusks. The insect food is dealt with in a separate chapter, of which the report by E. A. Schwarz occupies 11 pages. In the chapter on vegetable food this omnivorous bird's corn-pulling habits receive full consideration, as do also its relations to other grains and cultivated fruits. The natural foods most fully treated are mast, weed seeds, wild rice, and wild fruits, particularly sumacs. The bulletin contains casual references to the food of a few other species of birds, and closes with a statement of methods for protecting crops from crows and a discussion of bounty laws and their effects.

Bulletin 7. [The food and tongues of woodpeckers.] 44 pp. 5 pls. 1895. Preliminary report on the food of woodpeckers. By F. E. L. Beal [pp. 7–33, 1 pl. (frontispiece), figs. 1–4]. The tongues of woodpeckers. Relation of the form of the tongue to the character of the food. By Frederic A. Lucas [pp. 35–44, pls. 1–3].

Formal reports on the food habits of 7 species of woodpeckers and brief notes upon 3 others are given by Professor Beal. The introduction is devoted to a general statement of the food and comparison of the various species. Following this are tables showing the percentage of various elements of the food and the relative proportions of adult and larval Coleoptera found in the stomachs of 7 species of woodpeckers. Next the species are taken up separately and the animal and vegetable food and the damage attributed to the birds are fully discussed.

The report on tongues by Doctor Lucas notes the peculiarities of this organ in the different genera, discusses the value of these characteristics in classification, and draws conclusions concerning the relation of the form of the tongue to the character of the food. Plates I–III thoroughly illustrate this interesting anatomical essay.

Bulletin 8. The jack rabbits of the United States. By T. S. Palmer, M. D. 84 pp. 7 pls. 2 figs. 1896.

2nd ed. with numerous alterations and additions, including appendix of 5 pages. 88 pp. 7 pls. 3 figs. 1897.

The information relating to birds is the same in both editions and occurs on the same page, 44. Eight birds of prey are listed among the natural enemies of jack rabbits.

Bulletin 9. Cuckoos and shrikes in their relation to agriculture. 26 pp. 1 pl. 1 fig. 1898.

The food of cuckoos. By F. E. L. Beal, B. S. [pp. 7–14, fig. 1]. The food of shrikes. By Sylvester D. Judd, Ph. D. [pp. 15–26, 1 pl. (frontispiece)].

After noting briefly the general habits of the yellow-billed and black-billed cuckoos this bulletin treats their food habits collectively. The almost exclusively insect diet is discussed in detail, and a list is given of the species of insects identified in the stomachs. The food habits of the two species of shrikes are treated separately, and lists of the species identified among the prey are given. The report ends with a tabulation of the percentages of principal food elements by seasons.

Bulletin 12. Legislation for the protection of birds other than game birds. By T. S. Palmer. 94 pp. 2 pls. (maps). 8 figs. (1 map). 1900.

Revised edition. 143 pp. 4 pls. (maps). 7 figs. (1 map). 1902.

The remarks on bird food in this bulletin relate principally to species which, while often used as game, are outside of the ordinary classes of game birds. It is shown that several of these have very beneficial food habits, and their protection is urged. Brief statements of the character of the food of many other species are given in connection with synopses of legislation occasioned by their beneficial or injurious habits. Lists of the species protected and of those specifically exempted from protection in each State and in the Canadian provinces are presented, also the full text of Federal, State, and Canadian laws for the protection of birds.

Bulletin 13. Food of the bobolink, blackbirds, and grackles. By F. E. L. Beal, B. S. 77 pp. 1 pl. (map). 6 figs. 1900.

This bulletin contains formal reports on the food habits of the bobolink, the cowbird, and 7 species of blackbirds. The introduction notes the salient features of the food of the various species and compares them one with another. The individual treatment of the species comprises discussion of their relations to crops, particularly grain (rice in the case of the bobolink), and a complete synopsis of the remaining vegetable food and of the insect and other animal food. Tabulations of the principal food items, by months, follow the general account of each species, and diagrams graphically conveying the same information are given for the bobolink, cowbird, and red-winged blackbird.

BULLETIN 15. The relation of sparrows to agriculture. By Sylvester D. Judd, Ph. D. 98 pp. 4 pls. 19 figs. 1901.

The introductory matter in Bulletin 15 comprises a statement of the importance of sparrows, a general account of the principal constituents of their food, and a description of the methods of ascertaining the economic value of birds, including observations in the field and examination of stomachs in the laboratory. Under the food of sparrows as a group are discussed mineral substances found in sparrows' stomachs, food neutral in effect on agriculture, food injurious in effect, and food beneficial in effect. The behavior of sparrows and their habits of feeding in the natural state are described at length, and results of experiments with captive birds are compared with those of the investigation of stomach contents. The caged sparrows were also used to test the efficacy of the various so-called "protective" adaptations of insects, and the resistance of certain hard-coated seeds to the digestive action of the birds. The remainder of the bulletin is devoted to a discussion of the food of sparrows by species. Details of the animal and vegetable food of 26 species are given. Plate IV shows the percentages of the principal food items of 6 species by the graphic method of proportionate sectors of circles. The bulletin contains casual references to the food of numerous species of birds not formally treated.

BULLETIN 17. Birds of a Maryland farm. A local study of economic ornithology. By Sylvester D. Judd, Ph. D. 116 pp. 17 pls. (1 map). 41 figs. 1902.

"Birds of a Maryland Farm" is an account of the relations of all the birds occurring on a 230-acre farm near Marshall Hall to all of the animals and plants used by them for food. Several pages are devoted to a discussion of the local distribution of birds as influenced by topography, nesting facilities, and food supply. In Chapter II is described the behavior of birds during periods of unusual abundance of certain insects, as well as their relations to useful insects and to the standing pests of the various cultivated crops, trees, shrubs, and herbage. The food of the nestlings of several species is described in detail. Chapter III deals with the birds that prey upon poultry, wild birds, fish, carrion, mice, and rabbits, and Chapter IV with those that eat wild and cultivated fruit; this chapter contains also notes on the distribution of seeds by birds. The principal grain eaters are treated in Chapter V and the consumers of weed seed in Chapter VI. The remainder of the bulletin is devoted to a discussion of the food by species or by larger groups. Bulletin 17 represents the results of the most complete study of local economic ornithology that has been made. It gives notes on the food of no fewer than 133 species of birds.

BULLETIN 21. The bobwhite and other quails of the United States in their economic relations. By Sylvester D. Judd. 66 pp. 2 pls. (1 colored). 10 figs. 1905.

Two-thirds of this publication is devoted to a single species, the bobwhite. The discussion of the general habits of the bird, its value as food, as an object of sport, and as an asset on the farm, is very full. The decrease in numbers of the bird, legislation in its behalf, and measures for preservation and propagation, are considered at length. The food is dealt with under the following topics: Grain, weed seeds, mast and pine seeds, fruits, leaves and buds, beetles, bugs, grasshoppers and allied insects, caterpillars, miscellaneous animal food, and food of the young. One hundred and twenty-four different insects and other animals were identified in the stomachs and 138 seeds and fruits. Information of the same character, briefer in all cases, the volume depending on the number of stomachs available for examination, is given for six other species of quails.

BULLETIN 22. Birds known to eat the boll weevil. By Vernon Bailey. 16 pp. 1905.

This bulletin is a preliminary report on the investigations of boll-weevil-eating birds. Notes are given on 11 species of birds in whose stomachs E. A. Schwarz of the Bureau of Entomology found boll weevils and on 9 species added to this list by investigations by the Biological Survey. The field work was done by James G. Gaut and Vernon Bailey; the stomachs were examined by F. E. L. Beal.

BULLETIN 23. The horned larks and their relation to agriculture. By W. L. McAtee. 37 pp. 2 pls. 13 figs. 1905.

The horned larks of the United States belong to a single species composed of 21 subspecies. Their food habits are treated collectively in this bulletin, except for a Californian subspecies (*Otocoris alpestris actia*), which owing to environment is considerably more vegetarian than the other members of the group. The general habits and economic relations are first discussed, then the vegetable food is considered under the following heads: Wheat, corn, oats, other grains and forage plants, weeds, fruit, and miscellaneous vegetable food. The animal food, mineral matter, and food of the nestlings and other young horned larks precede the account of the California subspecies. This is followed by the summary and a list of seeds, fruits, and invertebrates eaten by the horned larks, which includes 77 items of animal food and 104 of vegetable.

BULLETIN 24. The grouse and wild turkeys of the United States and their economic value. By Sylvester D. Judd. 55 pp. 2 pls. (1 colored). 1905.

The food habits of 12 species of grouse and the wild turkey are described in this bulletin, the fullest accounts dealing with the prairie hen and the ruffed grouse. The insect food, which generally includes a goodly proportion of grasshoppers, and the vegetable food, characterized by the preponderance of berries, buds, and leaves, or browse, are discussed in detail. In the case of the ruffed grouse no fewer than 45 items of animal food and 120 of vegetable are listed.

BULLETIN 25. Birds that eat the cotton-boll weevil. A report of progress. By Arthur H. Howell. 22 pp. 1906.

This "report of progress" on the boll-weevil investigation adds 8 species to the list in Bulletin 22, making 28 in all known to feed on the weevil. The most important notes are those on the orioles, nighthawk, and flycatchers. On pages 19–20 is a brief discussion of the relations of birds to cotton worms. Tables giving the records of birds examined which had and which had not eaten boll weevils conclude the paper. The field work done since the publication of the first report (Bulletin 22) was by A. H. Howell; the stomachs were examined by F. E. L. Beal and W. L. McAtee.

Bulletin 27. The North American eagles and their economic relations. By Harry C. Oberholser. 31 pp. 2 pls. 2 figs. (maps). 1906.

This report is a compilation of information on the habits and distribution of 3 species of eagles—the bald, the golden, and the gray sea eagles. Their relations to fish, wild birds, poultry, and wild and domestic mammals are discussed and opinions given as to their economic status. Maps showing the breeding ranges of the bald eagle and the golden eagle are included in the bulletin.

Bulletin 29. The relation of birds to the cotton-boll weevil. By Arthur H. Howell. 31 pp. 1 colored pl. 6 figs. Oct. 10, 1907.

Bulletin 29 is a résumé of the study of birds in relation to the boll weevil. Forty-three species are listed (on page 6) as enemies of the insect, adding 15 to the list in Bulletin 25. Recommendations of measures designed to increase the efficiency of bird enemies of the pest include proposals for legislation in favor of the upland and killdeer plovers and the blackbirds, and suggestions for the special protection of swallows, meadow larks, and painted buntings. Nesting boxes for purple martins are described and illustrated. The relations of the various groups of birds to the boll weevil are described separately, the results of the field work of 1906 and 1907 are given, and the paper ends with tabulated records of birds examined which had and which had not eaten boll weevils. The field work was carried on by the author and the stomachs were examined by W. L. McAtee.

Bulletin 30. Birds of California in relation to the fruit industry. Part I. By F. E. L. Beal. 100 pp. 5 pls. (1 colored). Nov. 11, 1907.

The introductory paragraphs in this bulletin state the general problem of the relations of birds to cultivated fruit in California. They serve as an introduction to both Part I, the present bulletin, and Part II, issued as Bulletin 34. The status of birds in newly settled regions, the effect of migration on the economic relations, the causes of depredations, conditions in California compared with those in the Eastern States, and protective measures, such as the planting of decoy plants and provision of water supplies, are some of the subjects discussed in the introduction. It is shown that, while birds are usually destructive to crops in newly planted regions, "experience everywhere shows that after a time there is a partial readjustment of conditions, so that inroads by birds become much less common or wholly cease." The usual causes of damage by birds wherever or whenever occurring are defined; the principal bird enemies of fruit in California are named in order of importance, following which are the separate accounts of the species. The food habits of 35 species are fully discussed, including the most important species from the tanagers to the thrushes, in systematic order, together with the linnet, or house finch, the worst fruit pest among the birds in the State. The account of this species is based upon the examination of 1,206 stomachs. The food of the nestlings or young of several species is described, the most extended account dealing with those of the russet-backed thrush.

Bulletin 31. An economic study of field mice (genus Microtus). By David E. Lantz. 64 pp. 8 pls. 3 figs. Oct. 28, 1907.

In treating the natural enemies of field mice the author mentions some 50 species of birds, including shrikes, cuckoos, crows, herons, bitterns, storks, ibises, gulls, hawks, and owls. In many cases a brief summary of the general food habits of the species is given, and notes on the diet of the same bird in the Old World or of related European species are also presented.

Bulletin 32. Food habits of the grosbeaks. By W. L. McAtee. 92 pp. 4 pls. (3 colored). 40 figs. Feb. 29, 1908.

The pine and evening grosbeaks receive only passing mention, but the cardinal, gray, rose-breasted, black-headed, and blue grosbeaks are discussed in detail. The account of each species includes a description of the appearance of the bird, its distribution and habits, the details of its vegetable and animal food, mineral matter found in the stomachs, and the food of the nestlings and other young birds. Lists of the seeds, fruits, and invertebrates eaten by each species are given. One chapter discusses the relations of grosbeaks and other birds to parasitic insects. Some mention is made of the food of about 30 species of birds besides grosbeaks, these references occurring mainly in lists of bird enemies of rose chafers and potato beetles and in an account of birds that feed on mulberries.

Bulletin 33. The brown rat in the United States. By David E. Lantz. 54 pp. 3 pls. 4 figs. May 29, 1909.

Four owls and seven hawks are mentioned among the natural enemies of the brown rat. One of the owls is said to attack also the black rat.

Bulletin 34. Birds of California in relation to the fruit industry. Part II. By F. E. L. Beal. 96 pp. 6 colored pls. Aug. 8, 1910.

This bulletin continues the account of the food habits of California birds begun in Bulletin 30. It states that only four of the species of birds common in California (the linnet, California jay, Steller jay, and red-breasted sapsucker) can be regarded as of doubtful utility. The animal and vegetable food of 32 species is fully treated, especially in relation to fruit culture. As in Part I the food of the young is a special feature. Nestlings of 9 species were studied and reported upon, the fullest accounts dealing with the California towhee and the black-headed grosbeak. Part I discussed one species of the sparrow family, that worst fruit pest, the linnet, and important species of the families Tanagridæ (tanagers) to Turdidæ (thrushes) in the order of the check-list of North American Birds by the American Ornithologists' Union. Part II deals with the principal species in the families Tetraonidæ (grouse and quails) to Fringillidæ (sparrows, finches, and grosbeaks).

Bulletin 37. Food of the woodpeckers of the United States. By F. E. L. Beal. 64 pp. 6 pls. (5 colored). 3 figs. May 24, 1911.

The accumulation of woodpecker stomachs in the 16 years since the publication of Bulletin 7 enabled Professor Beal to present in Bulletin 37 formal reports on the food habits of 16 species, 9 more than were treated in the preliminary report. Brief notes upon the food of 6 other species also are included; the food of 11 species of woodpeckers which were not even mentioned in Bulletin 7 is discussed. Tables are given showing the comparative rank of the species as consumers of animal and vegetable food and of ants and beetles.

Bulletin 38. Birds of Arkansas. By Arthur H. Howell. 100 pp. 7 pls. (1 colored map). 4 figs. (maps). Oct. 12, 1911.

A section of the introduction to this bulletin is devoted to a general statement of the economic value of birds, and brief notes on the food of 126 species are scattered through the text.

Bulletin 39. Woodpeckers in relation to trees and wood products. By W. L. McAtee. 99 pp. 12 pls. (2 colored). 44 figs. Sept. 26, 1911.

This bulletin deals principally with the relations of three species of woodpeckers—the true sapsuckers—to living trees and the effect of their work upon the value of the articles into which the wood of these trees is manufactured. The sapsuckers are known to attack at least 258 trees, shrubs, and vines, of which 32 are sometimes killed and 63 seriously injured. Defects due to sapsucker work have been found in the wood of 174 species of trees, in 90 of which they are at times so serious as to spoil the appearance or workability of the wood, and in 22 species they sometimes render the wood useless except for coarse construction or for fuel. The damage done to fence posts, telephone poles, and buildings by 10 other species of woodpeckers is also discussed.

CIRCULARS.

The Biological Survey had its origin as a section of Economic Ornithology established under the Division (now Bureau) of Entomology. Four circulars of that division (Nos. 18, 20, 24, and 27) were published in the interest of the new subdivision, and one of them, No. 20, relates to the food habits of birds.

The earliest circulars of the Division of Economic Ornithology and Mammalogy were largely devoted to requests for information and letters of acknowledgment, which are now issued as "forms." Directions for preparing specimens, contained in Nos. 4, 11, and 12, and later Nos. 46 and 49, are still issued as circulars. Aside from these circulars, No. 17, Bird Day in the Schools, is the only one up to No. 27, inclusive, which is intended for the diffusion rather than the acquisition of knowledge.

Most of the circulars issued since No. 28 (1900) are short articles conveying information which it was desirable to give speedy publicity. Six of them are devoted to enonomic ornithology and five others contain brief references to the economic status of certain birds. Two of the latter (Nos. 29 and 38) were issued from the office of the Secretary and hence do not fall into the class of publications here indexed. No. 29, Protection and Importation of Birds under Act of Congress approved May 25, 1900, discusses the Lacey Act and refers (pp. 1, 3, 4, and 5) to prohibition of entry of injurious species, including the starling and English sparrow. No. 38, Interstate Commerce in Birds and Game, lists (p. 2) robins, swallows, cedar birds, meadowlarks, flickers, and nighthawks as insectivorous, and longspurs, snow buntings, and shore larks as useful in destroying weed seeds.

DIVISION OF ENTOMOLOGY.

CIRCULAR 20. [Circular on economic ornithology.] By Dr. C. Hart Merriam. [2 pp. of print and 2 blank for answers to questions, unnumbered.] July 1, 1885.

This circular briefly states the general problem of economic ornithology and the need of information. Questions relating to the food of 9 species of birds denote by implication the economic relations of these birds. The damage done in the South by the bobolink and red-winged blackbird is mentioned.

BIOLOGICAL SURVEY.

CIRCULAR 1. Circular on the food habits of birds. By Dr. C. Hart Merriam. [3 pp., not numbered.] July 20, 1886.

This circular consists largely of questions relating to the food habits of the crow, the crow blackbird, and the bobolink. Few direct statements are made regarding the food, but much is implied.

CIRCULAR 2. Circular on the English sparrow (*Passer domesticus*). By Dr. C. Hart Merriam. [1 p., unnumbered.] July 20, 1886.

Consists entirely of questions concerning the food of the English sparrow and its relations to other birds.

CIRCULAR 5. Circular to rice growers. By Dr. C. Hart Merriam. [1 p., unnumbered, 1886.]

Notes damage done to rice by the bobolink and red-winged blackbird and contains queries designed to bring out the nature and extent of the injury.

CIRCULAR 17. Bird day in the schools. By T. S. Palmer. 4 pp. July 2, 1896.

The history of bird day is given, the manner of its observance, and the objects and value of the day. Notes are given on the economic status of hawks, owls, and the English sparrow, and the bad results from bounty laws aimed against these birds.

CIRCULAR 34. Laws for the protection of birds and game in the District of Columbia. By T. S. Palmer. 8 pp. Oct. 25, 1901.

This circular quotes the Lacey Act, which contains the names of the starling and the English sparrow in the clause prohibiting the importation of injurious species.

CIRCULAR 56. Value of swallows as insect destroyers. By H. W. Henshaw. 4 pp. Apr. 27, 1907.

This circular shows the great value of swallows as insect destroyers and the importance of protecting them wherever found. It emphasizes the peculiar value of these birds in the war against the cotton-boll weevil, and asks the cooperation of citizens of Northern States, where these birds chiefly nest, in an effort to increase their numbers. The enemies of swallows, especially the English sparrow, are noted, and suggestions for preventing their attacks, as well as for attracting the swallows themselves, are given. The circular includes also directions for colonizing martins and for rearing their young.

Circular 57. Birds useful in the war against the cotton-boll weevil. By H. W. Henshaw. 4 pp. Apr. 27, 1907.

This circular directs attention to the importance of birds as enemies of the boll weevil and to the need of protecting them. Orioles, the nighthawk, and swallows are given special consideration and a few other species known to eat boll weevils are mentioned. Measures for protecting and attracting swallows are given. The suggestions for aiding the purple martin are especially full, including remarks on colonization, food for young, the English sparrow as an enemy, and the provision of martin houses.

Circular 61. Hawks and owls from the standpoint of the farmer. By A. K. Fisher. 18 pp. 6 figs. July 18, 1907.

This circular condenses the information presented in Bulletin 3 and is a direct revision of the article in the Yearbook for 1894 (pp. 215–232). Brief summaries of the food habits of 33 species of hawks and owls are given, and 14 others are merely mentioned in the list of those classed as chiefly beneficial.

Circular 64. Destruction of the cotton-boll weevil by birds in winter. By Arthur H. Howell. 5 pp. 1 map. June 19, 1908.

Thirty species of birds were discovered to feed upon the boll weevil in winter. Every death of a weevil at that season "prevents the production of very numerous progeny during the early summer and postpones the date when the increase will become so great as to destroy the cotton squares as fast as they appear." The more important species are the blackbirds, meadow larks, sparrows, titlarks, wrens, and titmice. According to Howell's estimates titlarks alone destroy about 72,000 boll weevils during the winter on each large plantation. The circular ends with a tabulated seasonal record of the birds which had eaten boll weevils. This list of 53 increases by 10 the number of species reported in Bulletin 29.

Circular 76. The California ground squirrel. By C. Hart Merriam. 15 pp. 4 figs. (1 map). Nov. 25, 1910.

Contains a few references to bird enemies of *Citellus beechyi*, and discusses danger to small birds from poisoned grain laid for the ground squirrels.

Circular 79. Our vanishing shorebirds. By W. L. McAtee. 9 pp. 3 figs. April 8, 1911.

The value of shorebirds has not been recognized in the past and they have been hunted until only a remnant of their once vast numbers is left. The fact that these birds have a decided economic value is demonstrated in this publication, and their protection is urged. The name ringed plover (*Aegialitis hiaticula*) near the bottom of p. 4 of this circular should be piping plover (*Aegialitis meloda*).

Circular 80. Progress of game protection in 1910. By T. S. Palmer and Henry Oldys. 36 pp. 1 fig. (map). June 29, 1911.

Classes the starling as injurious.

Circular 81. Three important wild duck foods. By W. L. McAtee. 19 pp. 19 figs. (3 maps). Sept. 9, 1911.

Written primarily to furnish information on the methods of propagating wild rice, wild celery, and pondweeds, this circular briefly notes the importance of these plants as food for 17 species of wild ducks. A table on the first page shows the percentages of the food of 16 species furnished by these plants.

FARMERS' BULLETINS.

FARMERS' BULLETIN 54. Some common birds in their relation to agriculture. By F. E. L. Beal, B. S. 40 pp. 22 figs. May, 1897.

Revised edition. 48 pp. 22 figs. March, 1904.

The original edition (1897) contains summaries of the food habits of 28 species and brief references to the nature of the food of 8 others. The revised edition (1904) contains 40 specific summaries and notes on 14 species. Farmers' Bulletin 54 is the one article on bird food to have if the complete series of bulletins and other publications of the Biological Survey is inaccessible. Many of the food summaries, though brief, are important, being based on the examination of large numbers of stomachs. Several of them, for instance those on the kingbird, cedar bird, robin, and bluebird, are the most comprehensive statements yet published on the economic relations of these common and important birds.

Farmers' Bulletin 54 has (up to Oct. 15, 1912) been reprinted 39 times, and a total of 595,000 copies has been distributed.

FARMERS' BULLETIN 160. Game laws for 1902. A summary of the provisions relating to seasons, shipment, sale, and licenses. By T. S. Palmer and H. W. Olds. 56 pp. 3 figs. (maps). 1902.

FARMERS' BULLETIN 180. Game laws for 1903. A summary of the provisions relating to seasons, shipment, sale, and licenses. By T. S. Palmer, Henry Oldys, and R. W. Williams, jr. 56 pp. 4 figs. (maps). 1903.

Each of these bulletins quotes the Lacey Act, a clause of which prohibits importation of the English sparrow and starling as injurious birds.

FARMERS' BULLETIN 197. Importation of game birds and eggs for propagation. By T. S. Palmer and Henry Oldys. 27 pp. 1 fig. (map). 1904.

Contains a note on the feeding habits of some capercaillie liberated in Algonquin National Park, Canada.

FARMERS' BULLETIN 335. Harmful and beneficial mammals of the arid interior, with special reference to the Carson and Humboldt Valleys, Nevada. By Vernon Bailey. 31 pp. 9 figs. Oct. 21, 1908.

Among the natural enemies of the Carson meadow mouse (*Microtus montanus*) are listed ravens, magpies, and shrikes. Each of these names can refer to only a single species in the region covered by the bulletin and for this reason is indexed. General references (such as hawks, owls, and birds of prey) are numerous but unfit for indexing.

FARMERS' BULLETIN 352. The Nevada mouse plague of 1907–8. By Stanley E. Piper. 23 pp. 9 figs. Mar. 20, 1909.

This bulletin comments on the destruction of many individuals of 5 species of birds by wheat poisoned with phosphorus, which was put out to kill meadow mice. Several birds are listed among the natural enemies of the mice.

FARMERS' BULLETIN 383. How to destroy English sparrows. By Ned Dearborn. 11 pp. 4 figs. Jan. 20, 1910.

A brief review of the food habits of the English sparrow is given in the introduction.

FARMERS' BULLETIN 390. Pheasant raising in the United States. By Henry Oldys. 40 pp. 17 figs. Apr. 18, 1910.

Crow mentioned among enemies of pheasants.

FARMERS' BULLETIN 456. Our grosbeaks and their value to agriculture. By W. L. McAtee. 14 pp. 3 figs. June 30, 1911.

An abstract of Biological Survey Bulletin 32, containing brief summaries of the food habits of five species of grosbeaks.

FARMERS' BULLETIN 470. Game laws for 1911. A summary of the provisions relating to seasons, shipments, sale, limits, and licenses. By Henry Oldys, C. E. Brewster, and Frank L. Earnshaw. 52 pp. 2 figs. (maps). August 21, 1911.

Starling and English sparrow mentioned as injurious.

NORTH AMERICAN FAUNAS.

This series of publications comprises the more technical papers, such as monographs of certain groups of mammals and descriptions of new species, in addition to accounts of the scientific results of explorations of certain States or other districts. The annotated lists of birds, which are a prominent feature of the latter class of faunas, often contain notes on bird food. These notes are usually definite records of stomach examinations or of observations in the field. They are indexed in detail; hence it is not necessary for users of the index to consult the pages of the faunas themselves, unless they desire to learn the combinations of items in individual stomachs, the quantity of food taken, or details of the feeding habits.

FAUNA 3. Results of a biological survey of the San Francisco Mountain region and desert of the Little Colorado, Arizona. 136 pp. 5 colored maps. 13 pls. 2 figs. Sept. 11, 1890.

Part 4.—Annotated list of birds of the San Francisco Mountain plateau and the desert of the Little Colorado River, Arizona. By Dr. C. Hart Merriam [pp. 1–101, pls. I–XI, colored maps 1–4].

FAUNA 5. Results of a biological reconnoissance of south-central Idaho. 132 pp. 4 pls. (1 colored). 4 figs. July 30, 1891.

Results of a biological reconnoissance of Idaho, south of latitude 45° and east of the thirty-eighth meridian, made during the summer of 1890, with annotated lists of the mammals and birds, and descriptions of new species. By Dr. C. Hart Merriam [pp. 1–108, pls. 1–4, figs. 1–4].

Fauna 7. The Death Valley expedition. A biological survey of parts of California, Nevada, Arizona, and Utah. 402 pp. 15 pls. 2 figs. 5 colored maps. May 31, 1893.

Report on the ornithology of the Death Valley expedition of 1891, comprising notes on the birds observed in southern California, southern Nevada, and parts of Arizona and Utah. By A. K. Fisher, M. D. [pp. 7–158, colored map 3].

Fauna 14. Natural history of the Tres Marias Islands, Mexico. 97 pp. 1 pl. [map]. 2 figs. April 29, 1899. Birds of the Tres Marias Islands. By E. W. Nelson [pp. 21–62].

Fauna 16. Results of a biological survey of Mount Shasta, California, by C. Hart Merriam. 179 pp. 5 pls. 46 figs. October 28, 1899.

Fauna 19. Results of a biological reconnoissance of the Yukon River region. 100 pp. 7 pls. [1 map]. Oct. 6, 1900. Birds of the Yukon region, with notes on other species. By Louis B. Bishop, M. D. [pp. 47–96].

Fauna 21. Natural history of the Queen Charlotte Islands, British Columbia. Natural history of the Cook Inlet region, Alaska. By Wilfred H. Osgood. 87 pp. 7 pls. [1 map]. 1 fig. [map]. Sept. 26, 1901.

Fauna 22. A biological investigation of the Hudson Bay region. By Edward A. Preble. 140 pp. 14 pls. [1 map]. Oct. 31, 1902.

Fauna 24. A biological reconnoissance of the base of the Alaska Peninsula. By Wilfred H. Osgood. 86 pp. 7 pls. [2 maps]. Nov. 23, 1904.

Fauna 25. Biological survey of Texas. Life zones, with characteristic species of mammals, birds. reptiles, and plants. Reptiles, with notes on distribution. Mammals, with notes on distribution, habits, and economic importance. By Vernon Bailey. 222 pp. 16 pls. [6 maps]. 24 figs. [16 maps]. Oct. 24, 1905.

Fauna 27. A biological investigation of the Athabaska-Mackenzie region. By Edward A. Preble. 574 pp. 25 pls. [4 maps]. 16 figs. [4 maps]. October 26, 1908.

Fauna 30. Biological investigations in Alaska and Yukon Territory. 1. East central Alaska. 2. The Ogilvie Range, Yukon. 3. The Macmillan River, Yukon. By Wilfred H. Osgood. 96 pp. 5 pls. [1 map]. 2 figs. [maps]. October 7, 1909.

Fauna 33. A biological survey of Colorado. By Merritt Cary. 256 pp. 12 pls. [1 map]. 39 figs. [29 maps.] Aug. 17, 1911.

ANNUAL REPORTS.

Each of the Annual Reports of the Department of Agriculture consists of the report of the Secretary of Agriculture together with those of the chiefs of the various bureaus and divisions. Only the reports of the Chief of the Bureau of Biological Survey and of its predecessor, the Division of Ornithology and Mammalogy, are of interest in the present connection. The first report deals with economic investigations carried on from July 1, 1885, to February 20, 1887, a period of more than one and a half years. All subsequent reports cover approximately a period of one year.

Up to and including the Report for 1893, original articles corresponding to those now published in the Yearbook, and written by various members of the division, accompanied the reports of the chief. Seventeen of them appeared in the eight reports specified. Beginning with that for 1894 the reports of the chief are of a more routine character, containing the customary review of the year's work, plans for the succeeding year, and recommendations. Frequently, however, specific references to bird food are made and all of these are indexed. The comment on each report in the following bibliography gives an idea of the subjects more generally treated.

1886

Report of ornithologist and mammalogist. By C. Hart Merriam. pp. 227–258. 2 figs. 1 colored map.

This first report includes a preliminary discussion of the economic relations of the English sparrow, describes the depredations on rice of bobolinks and red-winged and boat-tailed blackbirds, and refers casually to the food of several other birds.

1887.

Report of the ornithologist and mammalogist. [By C. Hart Merriam.] pp. 399–401.

Notes progress of the investigation of the English sparrow and considers the feasibility of the use of trained hawks in keeping bobolinks out of rice fields.

Food of hawks and owls. By Dr. A. K. Fisher. pp. 402–422.

Consists mainly of a tabulation of contents of 1,072 stomachs, representing 28 species of hawks and owls.

Experiments in poisoning. By Dr. A. K. Fisher. pp. 423–426.

States efficiency in poisoning English sparrows of various preparations of strychnine, arsenic, and corrosive sublimate, in combination with wheat, meal, and hempseed.

Report on some of the results of a trip through parts of Minnesota and Dakota. By Vernon Bailey [birds, pp. 428–431].

Discusses the relations of blackbirds, cowbirds, and bobolinks to the grain crops in this region. Notes on some other articles of diet are given for these birds as well as for a few other species.

Notes on the depredations of blackbirds and gophers in northern Iowa and southern Minnesota in the fall of 1887. By Dr. A. K. Fisher [birds, pp. 454–455].

This report is supplementary to the last, dealing with the habits of the birds in fall and estimating the percentage of destruction, while Mr. Bailey described the depredations that occurred in spring.

1888.

Report of the ornithologist and mammalogist. By C. Hart Merriam. pp. 477–484.

Describes the progress of work on various economic projects and gives an example of one of the labels used on a collection exhibited at the Centennial Exposition of the Ohio Valley and Central States, Cincinnati, July–November, 1888, which contains a brief statement of the food of the red-tailed hawk.

Introduced pheasants. By Dr. C. Hart Merriam. pp. 484–488.

This paper gives an account of the introduction of pheasants and sand grouse into Oregon and Washington. Notes on damage to field and garden crops apparently pertain solely to the ring pheasant (*Phasianus torquatus*).

The sparrow hawk (*Falco sparverius*). By Dr. A. K. Fisher. pp. 491–496. 1 fig.

A review of the testimony of observers as to the economic value of the sparrow hawk, together with a report upon the examination of 163 stomachs.

The short-eared owl (*Asio accipitrinus*). By Dr. A. K. Fisher. pp. 496–498. 1 fig.

Summarizes the recorded observations upon this bird's food and states briefly the results of 50 stomach examinations.

The food of crows. By Walter B. Barrows, S. B. pp. 498–535.

This is a preliminary presentation of the material elaborated later in Bulletin 6 of the Biological Survey. Both the common crow (*Corvus brachyrhynchos*) and the fish crow (*Corvus ossifragus*) are treated, and the results of examination of 86 stomachs of the former and 12 of the latter are given. The economic relations of crows are discussed under the following headings: Injury to corn, wheat, and other cereals; damage to other crops; other vegetable food; the distribution of noxious seeds; the destruction of the eggs and young of poultry and wild birds; insect food; the crow as an enemy of field mice and other small quadrupeds; miscellaneous animal food; and the crow as a scavenger.

The rose-breasted grosbeak (*Habia ludovicana*). An enemy to the Colorado beetle or potato bug. [By W. B. Barrows.] pp. 535–536.

Compiles field observations on this point and emphasizes value of the bird.

1889.

Report of ornithologist and mammalogist. By C. Hart Merriam. pp. 363–370.

Contains references to the food of several species of birds then being investigated by the division.

Marsh hawk. *Circus hudsonius.* By Dr. A. K. Fisher. pp. 370–372. Plate I (colored).

Common screech owl. *Megascops asio.* By Dr. A. K. Fisher. pp. 372–376. Plate II (colored).

Flammulated screech owl. *Megascops flammeolus.* [By Dr. A. K. Fisher.] p. 376.

These three articles are arranged on the same plan, each stating the range of the species treated and its general habits, following this with a compilation of what has been observed regarding its food habits.

1890.

Report of the ornithologist and mammalogist. By C. Hart Merriam. pp. 277–280.

The general nature of the food of crows and the relation of meadowlarks to clover seed are briefly discussed and the economic value of a few other species is mentioned.

Seed planting by birds. By Walter B. Barrows. pp. 280–285.

The agency of birds in distributing the seeds of certain fleshy fruits is the principal topic of this article, but references to other features of bird food habits are included.

Birds which feed on mulberries. By Dr. C. Hart Merriam. p. 285.

The fact is noted that when mulberries are ripe many insectivorus birds forsake their chief diet for the time to feed upon this luscious fruit. A list of 26 species of birds observed to eat mulberries is given.

1891.

Report of the ornithologist and mammalogist. By C. Hart Merriam. pp. 267–271.

Contains a brief review of the economic investigations of the year, putting especial emphasis upon the importance of the English sparrow problem.

1892.

Economic ornithology. By W. B. Barrows. pp. 193–197.

This takes the place of that section of the report of the chief customarily devoted to a review of the economic work of the year. It contains also, however, a preliminary report on the food of horned larks, based upon the examination of 59 stomachs.

Food habits of the cedar bird (*Ampelis cedrorum*). By F. E. L. Beal. pp. 197–200.

The results reached from the examination of 125 stomachs are as follows: (1) That cedar birds eat a certain amount of insect food at all times when it can be obtained, aggregating in the case of the stomachs examined 17 per cent of the food for the whole year; (2) that the greatest amount of insect food is eaten during the months (especially May) when fruit is most abundant; (3) that the young in the nest are fed to a very great extent upon insect food.

1893.

Food habits of the kingbird or bee martin (*Tyrannus tyrannus*). By Walter B. Barrows. pp. 233–234.

This report gives the results of the examination of 171 stomachs, particular attention being paid to the bird's relation to honeybees.

1895.

Report of the chief of the Division of Ornithology and Mammalogy. By C. Hart Merriam. pp. 175–178.

Reference is made to a proposed New York law placing a bounty on English sparrows.

1898.

Report of the acting chief of the Division of Biological Survey. By T. S. Palmer. pp. 37–42.

Contains general reference to the caterpillar-eating habits of cuckoos and the destruction of weed seeds by sparrows.

1899.

Report of the acting chief of the Division of Biological Survey. By T. S. Palmer. pp. 59–70.

This report discusses an effort made to reduce the number of English sparrows in the parks of Boston. The proposed introduction of the great titmouse and blue tit of Europe also receives consideration, and comments are made upon the economic status of these birds. The evil results of the introduction of European sparrows, thrushes, blackbirds, and starlings into Australia and New Zealand are cited as examples of what might result were these birds brought into the United States, Hawaii, or Porto Rico.

1900.

Report of the acting chief of the Division of Biological Survey. By T. S. Palmer. pp. 35–48.

Contains brief references to the nature of the food of a few species, and reviews the Lacey Act, which prohibits the introduction of English sparrow and starling.

1901.

Report of the acting chief of the Division of Biological Survey. By T. S. Palmer. pp. 151–162.

Three species of birds injurious to fruit in California are mentioned.

1902.

Report of the chief of the Division of Biological Survey. By C. Hart Merriam. pp. 209–218.

Three species of introduced birds which have proved injurious in Hawaii are named, and a case is recorded in which the great titmouse was denied admission to the United States.

1904.

Report of the chief of the Division of Biological Survey. By C. Hart Merriam. pp. 291–305.

This report mentions bird enemies of the codling moth in California, discusses the relation of birds to honeybees, and comments on the importation of 3 species of injurious birds.

1905.

Report of the chief of the Division of Biological Survey. By C. Hart Merriam. pp. 303–315.

A brief statement of the economic value of horned larks and grosbeaks is included in this report.

1906.

Report of the acting chief of the Bureau of Biological Survey. By Henry W. Henshaw. pp. 397–418.

Includes brief discussion of the following topics: Ravages of geese in California grainfields, birds in relation to the cotton-boll weevil, economic value of eagles, also of grosbeaks, food of wild ducks, and means of attracting birds.

1907.

Report of the chief of the Bureau of Biological Survey. By C. Hart Merriam. pp. 485–505.

This report discusses scale-eating birds, grosbeaks, the English sparrow, and the relation of birds to the cotton-boll weevil.

1908.

Report of the chief of the Bureau of Biological Survey. By C. Hart Merriam. pp. 571–590.

The economic topics receiving consideration in this report are as follows: Relation of birds to the cotton-boll weevil, California birds in relation to the fruit industry, food of wild ducks, food of woodpeckers, mosquito-eating birds, birds in relation to the codling moth, the spread of the English sparrow in southern California, and means of attracting birds. European skylarks and song thrushes imported for liberation were denied admission, and an investigation of the economic status of the starling is announced.

1909.

Report of the chief of the Bureau of Biological Survey. By C. Hart Merriam. pp. 533–551.

The problem of keeping English sparrows out of southern California receives further attention in this report. Other economic subjects considered are the food of woodpeckers, flycatchers, wild ducks, and shorebirds; birds in relation to wheat aphids, to the boll weevil, and to the fruit industry in California; and the exclusion of injurious species from Hawaii.

1910.

Report of the chief of the Bureau of Biological Survey. By H. W. Henshaw. pp. 549–565.

The economic topics dealt with in this report are as follows: Injury to timber by woodpeckers, food of wild ducks and flycatchers, and birds in relation to the gypsy and brown-tail moths.

SCHEDULES.

The series known as schedules, with one exception, consists of blank forms for the recording of data. No. 4, devoted to questions concerning the economic status of the English sparrow, is indexed.

Schedule 4. Schedule on the English sparrow (*Passer domesticus*). By Dr. C. Hart Merriam [1 p., unnumbered, 1886].

Consists wholly of questions on the presence, abundance, relations to other birds, food, and injurious habits of the English sparrow.

YEARBOOKS.

The Yearbook of the United States Department of Agriculture had its origin in a desire to separate papers of a scientific character, with which the annual reports were becoming burdened, from the administrative reports of the various bureaus and divisions. The first Yearbook, that for 1894, was issued in 1895 and this relation of date of publication to date of volume holds throughout the series. The Yearbook consists principally of special reports and papers which are designed to interest and instruct.

In the 17 volumes thus far issued (including 1910) the Biological Survey has furnished 32 articles dealing to some degree with the food of birds.

1894.

Hawks and owls as related to the farmer. By A. K. Fisher, M. D. pp. 215–232. Pls. I–III. figs. 21–24.

This article is a condensation of Bulletin 3 of the Biological Survey. It contains lists of the wholly beneficial, chiefly beneficial, and harmful hawks and owls, as well as those in which harmful and beneficial qualities about balance. The food habits of 32 species are briefly reviewed.

The crow blackbirds and their food. By F. E. L. Beal. pp. 233–248. fig. 25.

This is the most authoritative account of the food of any species of bird, being based upon the examination of 2,258 stomach contents. The paper takes account also of printed and communicated testimony on the food of the crow blackbird. The grains and fruits eaten, animal food, and food of the young are all carefully considered. Depredations on grain and various other injurious traits are admitted, while on the other hand the birds are stated to do incalculable good by destroying insects.

1895.

Four common birds of the farm and garden. By Sylvester D. Judd. pp. 405–418. figs. 106–109.

The four common birds referred to are the catbird, mockingbird, brown thrasher, and house wren. The range and general habits of each are described; attention is given to any complaints that have been made against the species, and the evidence as to food derived from stomach examination and from experiment are discussed. The verdict is favorable to the brown thrasher and wren, unfavorable to the catbird, and in the case of the mockingbird, from lack of material, judgment is suspended.

The meadow lark and Baltimore oriole. By F. E. L. Beal. pp. 419–430. figs. 110–111.

Although these birds belong to the same family, they have very different habits. The terrestrial meadow lark feeds to a great extent upon grasshoppers, while the most important item of the insect food of the arboreal oriole is caterpillars. The other items of food of both species are fully discussed, and the verdict in each case is in favor of the bird.

Professor Beal points out an error in the calculation on page 422 of the amount saved a township by meadow larks feeding on grasshoppers. The final figure should be about $356, instead of $24. This change was made in the reprints.

Erroneous ideas concerning hawks and owls. [By A. K. Fisher.] p. 590.

Most of this short note is a quotation of the economic classification of the hawks and owls given by Doctor Fisher in the Yearbook for 1894, pp. 217–218.

1896.

Extermination of noxious animals by bounties. By T. S. Palmer. pp. 55–68.

The history of bounty legislation in the United States, expense of the system, objections to it, and the results accomplished are discussed. As bounties have been paid on several kinds of birds, the economic status of the species affected receives passing notice.

The blue jay and its food. By F. E. L. Beal. pp. 197–206. figs. 40–42.

This is a complete discussion of the range, habits, and economic value of the blue jay. Details are given as to the insect and vegetable food. Experiments to determine preferences of a captive jay are described. Except for the nest-robbing proclivities of the jay, upon which final judgment is not passed, the bird is thought to do far more good than harm.

Erroneous ideas concerning hawks and owls. [By A. K. Fisher.] p. 628.

Comment under same title in previous Yearbook applies here.

1897.

Birds that injure grain. By F. E. L. Beal. pp. 345–354.

Professor Beal discusses the cause of the increase in numbers of the principal grain-eating birds, outlines the damage done, and gives somewhat extended accounts of the food habits of 5 species, particularly in relation to grain. Four other species are briefly mentioned.

Useful birds and harmful birds. [By Biological Survey.] p. 670.

This is a tabulation of twenty-five species which are decidedly beneficial to agriculture and should be rigidly protected, and of five species which are injurious and unworthy of protection, with a brief statement of principal foods of each.

1898.

The danger of introducing noxious animals and birds. By T. S. Palmer. pp. 87–110. Pl. VIII. figs. 1–6 (1 map).

This paper reviews the experience of various foreign countries with the introduction of certain mammals and birds, points out the evil results of the importation of the English sparrow into the United States, and calls attention to the danger of similar results arising in other cases if introductions are not controlled. The economic status of 11 species of birds is more or less fully discussed.

Birds as weed destroyers. By Sylvester D. Judd, Ph. D. pp. 221–232. Pl. XV. figs. 59–65.

This is a résumé of the seed-eating habits of all the species known to have any importance as destroyers of weed seeds. Some forty species of birds are mentioned.

The name "clay-colored longspur," bottom of page 226, is unidentifiable.

1899.

A review of economic ornithology in the United States. By T. S. Palmer. pp. 259–292. Pls. VI–VIII (1 map).

This article traces briefly the development of American ornithology in general, but it consists largely of a discussion of the study of birds from the standpoint of dollars and cents. The principal topics relating to bird food are: Investigations as to the value of birds, commencement of investigations along modern lines, a period of notable advance in investigations, and work of the Biological Survey. That section of the paper entitled "Measures for the Destruction, Preservation, and Introduction of Birds" also contains comments on the food habits of several species.

1900.

How birds affect the orchard. By F. E. L. Beal, B. S. pp. 291–304. figs. 34–38.

Birds affect orchards directly by stealing fruit, feeding upon buds, flowers, or the inner bark and sap of the trees, and indirectly by destroying mammals and insects injurious to orchards. This article gives brief accounts of the birds most important in these relations.

The food of nestling birds. By Sylvester D. Judd, Ph. D. pp. 411–436. pls. 49–53. figs. 48–56.

In some cases the food of nestling birds is radically different from that of their parents. When this is the case the difference usually consists in the preponderance of animal food, particularly that of a soft nature, in the diet of the young birds. Dr. Judd describes at varying length the food habits of the nestlings of about 80 species of birds. Incidentally, characteristics of the food of many adults are noted. Dr. Judd introduces in this paper his excellent graphic representation, by means of sectors of a circle, of the proportions of various items in the food of birds. Part of these diagrams are made much more effective by the addition of small figures illustrating a typical member of a group within its particular sector. The article includes an estimate of the value of the crops saved daily by the destruction of locusts by nestling birds in eastern Nebraska during the invasions of Rocky Mountain locusts.

1901.

Two vanishing game birds—the woodcock and the wood duck. By A. K. Fisher. pp. 447–458. pls. 63–64. figs. 37–39 (1 map).

Brief notes on the food of each of these species are given.

1902.

Audubon societies in relation to the farmer. By Henry Oldys. pp. 205–218. pls. 21–22. figs. 11–12 (maps).

This article includes a general statement of the economic value of birds, together with a few specific notes on bird food.

1903.

The economic value of the bobwhite. By Sylvester D. Judd, Ph. D. pp. 193–204. pl. 16 (colored).

This very comprehensive account of the bobwhite includes a statement of its range and general habits; treats the bobwhite as a weed and insect destroyer, as an article of food, and as an object of sport; and discusses measures for the preservation of the species. A very full list of the seeds, fruits, insects, and other invertebrates eaten by the bird concludes the article.

It is now stated upon reliable authority that the record quoted on p. 196 to the effect that 47 cotton-boll weevils were eaten by a bobwhite in one morning is based on observations upon a captive bird. The statement has no value, therefore, as an indication of the relation of bobwhite to the boll weevil under normal conditions.

1904.

The relation of birds to fruit growing in California. By F. E. L. Beal. pp. 241–254.

Most of this article is devoted to the discussion of the species injurious to fruit, but some of the chief enemies of fruit pests are briefly mentioned.

Some benefits the farmer may derive from game protection. By T. S. Palmer. pp. 509–520.

Contains a few notes on the protection of useful birds and prevention of the introduction of injurious species.

1905.

Meadow mice in relation to agriculture and horticulture. By D. E. Lantz. pp. 363–376. pls. 38–41. fig. 89.

A full account of the natural enemies is given, which includes notes on many species of birds.

Federal game protection—a five years' retrospect. By T. S. Palmer. pp. 541–562. pl. 70. figs. 113–125 (maps).

This article names three species of birds denied admission to the United States under authority of the Lacey Act.

1906.

Cage-bird traffic of the United States. By Henry Oldys. pp. 165–180. pls. 8–9.

Refers to damage in rice fields by Java sparrows.

Birds that eat scale insects. By W. L. McAtee. pp. 189–198. figs. 1–3.

Previous to the publication of this paper little had been made public concerning the destruction of scale insects by birds. Indeed, currency had been given to a statement that birds never feed upon scales. However, 57 species are recorded as enemies of various scale insects, 29 of them being known to feed upon the black olive scale, one of the most injurious species in the United States.

1907.

Does it pay the farmer to protect birds? By H. W. Henshaw. pp. 165–178. pls. 6–9.

This article discusses, in a general way, the value of the principal groups of insectivorous birds. The habits or items of food of a number of species are mentioned.

The rabbit as a farm and orchard pest. By D. E. Lantz. pp. 329–342. pls. 37–38. fig. 34.

Seventeen species of raptorial birds are mentioned among the natural enemies of rabbits.

1908.

The economic value of predaceous birds and mammals. By A. K. Fisher. pp. 187–194. pls. 1–3.

The notes on bird food in this article relate principally to hawks, owls, herons, and gulls.

Mouse plagues, their control and prevention. By Stanley E. Piper. pp. 301–310. pls. 21–25.

The natural enemies of *Microtus montanus* are given their due share of attention, a few birds being specifically mentioned. A list is also given of birds killed by poisoned grain laid for the mice.

The relations between birds and insects. By F. E. L. Beal. pp. 343–350.

The principal points made in this paper are that birds are a very important check upon insects and that their true function is not so much to destroy this or that insect pest as it is to lessen the numbers of the insect tribe as a whole. While the bulk of the paper consists of a general discussion of the relations between birds and insects, definite notes on the food of a few species are given.

1909.

Plants useful to attract birds and protect fruit. By W. L. McAtee. pp. 185–196.

This article mentions the plants most useful for attracting fruit-eating birds, and gives lists of species suitable for various sections of the United States. It includes also brief notes on other phases of bird attraction. The favorite foods of a few species of game birds are named.

Pocket gophers as enemies of trees. By David E. Lantz. pp. 209–218. pls. 8–10. fig. 1.

The fact is noted that barn owls and great blue herons are of great value as enemies of pocket gophers.

Introduction of the Hungarian partridge into the United States. By Henry Oldys. pp. 249–258. Pl. 14.

Includes a brief statement of the nature of the food.

INDEX.

Notes relating to a species of bird are brought together under its current scientific name and cross references from the common name, and in some cases from certain once familiar scientific names, are inserted. The scientific names of North American birds correspond with those of the Check-list prepared by a committee of the American Ornithologists' Union, New York, 1910. Subspecies are not separately mentioned, except when the typical subspecies is extralimital or only one subspecies has been treated.

The number of stomachs analyzed is noted in the case of all formal reports, of other original investigations as "Birds of a Maryland Farm" or "Birds of California in Relation to the Fruit Industry," and of those publications including original matter as Farmers' Bulletin 54 and Circular 61. Publications are referred to in the index by the following abbreviations: Bul.—Bulletin, Circ.—Circular, Ent. Circ.—Circular of Division of Entomology, F. Bul.—Farmers' Bulletin, Fauna—N. A. Fauna, Rept.—Annual Report, and Ybk.—Yearbook. The particular bulletin, circular, farmers' bulletin, or fauna is designated by its number, the report or yearbook by the year for which it was issued. Bold-faced figures indicate the pages containing the principal account. The other pages usually contain short notes or merely incidental mention of the food.

A.

Acanthis hornemanni exilipes—Hoary redpoll.
  Feeding on aments of alder, Fauna 24, p. 73; seeds of alders (*Alnus incana* and *A. alnobetula*), canoe birch (*Betula papyrifera*), and dwarf birch (*Betula nana*), Fauna 27, p. 418.

Acanthis linaria—Redpoll.
  Feeding on weed seeds, Ybk. 1898, pp. 222, 229, 230.

Accipiter atricapillus, see Astur atricapillus.

Accipiter cooperi—Cooper's hawk.
  Brief account, Bul. 31, pp. 45, 46; Bul. 38, p. 38; Circ. 61, pp. 3, 17, 18; Ybk. 1894, pp. 218, **231–232**; Ybk. 1900, p. 429.
  Feeding on Beechey's spermophile, Fauna 7, p. 36; bobwhite, Bul. 21, p. 22; birds, Fauna 3, pp. 38, 90; Ybk. 1908, p. 192; Canada grouse, Fauna 22, p. 106; English sparrow, Bul. 1, p. 32; field mice, Bul. 31, pp. 45, 46; poultry, Bul. 6, p. 39; Bul. 21, p. 22; Ybk. 1908, p. 192; rabbits, Ybk. 1907, p. 336; ruffed grouse, Bul. 24, p. 28; sparrows, Bul. 15, p. 36; spermophiles, Bul. 4, pp. 16–17.
  Food at Marshall Hall, Bul. 17, pp. 19, **50–51**, 54, 110.
  Food of nestlings, Ybk. 1900, p. 429.
  Formal report, Bul. 3, pp. 15, 16, **38–43**, 175 (133 stomachs); Rept. 1887, pp. 402, **405** (46 stomachs).
  Injurious, Bul. 12, pp. 30, 36, 49; Bul. 12 (rev.), pp. 32, 33, 43, 58; Bul. 38, p. 10; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.

Accipiter velox—Sharp-shinned hawk.
  Brief account, Bul. 31, pp. 45, 46; Bul. 38, p. 38; Circ. 61, pp. 3, **17–18** (107 stomachs); Ybk. 1894, pp. 218, 231, **282**; Ybk. 1900, p. 429.
  Feeding on birds, Ybk. 1908, p. 192; bobwhite, Bul. 21, p. 22; English

Accipiter velox—Continued.

sparrow, Bul. 1, p. 32; field mice, Bul. 31, pp. 45, 46; flicker and Gambel's (intermediate) sparrow, Fauna 19, p. 73; pileolated warbler (*Wilsonia pusilla pileolata*), Fauna 5, p. 94; poultry, Ybk, 1908, p. 192; sparrows, Bul. 15, p. 36; thrush, Fauna 19, p. 72; woodcock, Ybk. 1901, p. 450.

Food at Marshall Hall, Bul. 17, pp. 19, 51–52, 54, 110.

Formal report, Bul. 3, pp. 15, 16, 32–37, 38, 43 (159 stomachs); Rept. 1887, pp. 402, 404 (48 stomachs).

Injurious, Bul. 12, pp. 30, 36, 49; Bul. 12 (rev.), pp. 32, 33, 43, 58; Bul. 38, p. 10; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.

Acredula caudata, see Ægithalos caudatus.

Acridotheres tristis—Common myna.

Economic status, introduction dangerous, etc., Ybk. 1898, pp. 90, 103–104, 107, 109.

Injurious in Hawaii, Bul. 12 (rev.), p. 87; Rept. 1902, p. 213; Ybk. 1899, p. 290.

Protection denied in Hawaii, Bul. 12 (rev.), p. 87.

Actitis macularia—Spotted sandpiper.

Brief account, Bul. 38, p. 32.

Feeding on army worms, Circ. 79, p. 6; cabbage worms, Circ. 79, pp. 7–8; crayfishes, Circ. 79, p. 6; cutworms, Circ. 79, pp. 7–8; grasshoppers, Circ. 79, p. 2; green flies and squash bugs, Circ. 79, pp. 7–8.

Food at Marshall Hall, Bul. 17, pp. 19, 23, 24, 34, 38, 83.

Food of nestlings, Ybk. 1900, p. 433.

Ægialitis hiaticula—Ringed plover; occurs in Greenland, Circ. 79, p. 2, error for Ægialitis meloda, which see.

Ægialitis meloda—Piping plover.

Feeding on grasshoppers, Circ. 79, p. 2.

Ægialitis nivosa—Snowy plover.

Feeding on *Ephydra hians*, Fauna 7, p. 25.

Ægialitis semipalmata—Ringneck.

Feeding on grasshoppers and mosquitoes, Circ. 79, p. 2.

Ægithalos caudatus—Long-tailed titmouse.

Feeding on scale insects, Ybk. 1906, p. 191.

Agelaius gubernator californicus—Bicolored redwing blackbird.

Food in California, Bul. 34, pp. 56–59 (198 stomachs).

Formal report, Bul. 13, pp. 9, 10, 44–45 (61 stomachs).

Agelaius phœniceus—Redwing blackbird.

Bounty laws, Ybk. 1896, p. 57.

Brief account, Bul. 12, p. 21; Bul. 38, p. 57; F. Bul. 54, pp. 19–21 (725 stomachs); F. Bul. 54 (rev.), pp. 24–26 (1,083 stomachs); Ybk. 1897, pp. 345, 349–351, 353; Ybk. 1900, pp. 422–423.

Damage done, Bul. 12 (rev.), p. 28; Bul. 15, p. 17; Bul. 38, p. 57; Ent. Circ. 20 [p. 2]; Rept. 1886, pp. 242, 246–249; Rept. 1887, pp. 428, 429, 430, 431, 454, 455, 456; Rept. 1900, p. 44; Ybk. 1897, pp. 345, 349–351, 353; Ybk. 1898, p. 230.

Feeding on boll weevils, Bul. 22, pp. 10–11, 16; Bul. 25, pp. 8, 9, 12, 21; Bul. 29, pp. 6, 7, 18, 29, 30; Bul. 38, p. 57; Circ. 64, pp. 3, 5; grain, Fauna 7, p. 74; Rept. 1887, pp. 428, 429, 430, 431, 454, 455, 456; Rept. 1900, p. 44; Ybk. 1897, pp. 345, 349–351, 353; Ybk. 1898, p. 230; rice, Bul. 15, p. 17; Bul. 22, pp. 11, 16; Bul. 38, p. 57; Circ. 5 [p. 1]; Rept. 1886, pp. 234, 242, 246–249; weed seeds, Bul. 29, p. 8; Ybk. 1898, p. 230.

Food at Marshall Hall, Bul. 17, pp. 20, 23, 24, 32, 35, 38, 40, 69, 70, 71, 77, 95–96, 111 (8 stomachs).

Food in California, Bul. 34, p. 59 (12 stomachs).

Food of nestlings, Ybk. 1900, pp. 422–423.

Formal report, Bul. 13, pp. 8, 9, 11, 33–44 (1,083 stomachs).

Other notes, Bul. 15, p. 29; Bul. 22, pp. 11, 16.

References to studies of food habits, Ybk. 1899, p. 266.

Request for information on economic relations, Ent. Circ. 20 [p. 2]; Circ. 5 [p. 1]; Rept. 1886, p. 234.

Agelaius tricolor—Tricolored redwing blackbird.

Food in California, Bul. 34, p. 59 (16 stomachs).

Aix sponsa—Wood duck.

Brief account, Bul. 38, p. 20; Ybk. 1901, p. 455.

Food of nestlings, Ybk. 1900, p. 435.

Vegetable food, Circ. 81, pp. 1, 2.

Alauda arvensis—Skylark.

Admission denied, Rept. 1908, p. 581.

Brief account, Bul. 23, p. 11.

Economic status, introduction dangerous, etc., Ybk. 1898, pp. 90, 106, 107, 109.

Injurious in New Zealand, Ybk. 1909, p. 257.

Pulling grain, Bul. 1, p. 341.

Sale in market, Bul. 23, p. 11.

Aluco flammeus—Old-world barn owl.

Enemy of field mice, Bul. 31, pp. 46–47, 48.

Aluco pratincola—American barn owl.

Beneficial, Ybk. 1895, p. 590; 1896, p. 628; Ybk. 1897, p. 670.

Brief account, Bul. 31, pp. 46, 47, 48; Bul. 38, p. 41; Circ. 61, pp. 3,

Aluco pratincola—Continued.
10–11 (200 pellets); Ybk. 1894, pp. 217, 223–224; Ybk. 1900, pp. 301, 430.

Feeding on bats, Fauna 7, p. 42; black rat, Bul. 33, pp. 34–35; Brewer's blackbird, Bul. 5, p. 21; Ybk. 1909, p. 217; brown rat, Bul. 33, pp. 34–35; chipmunk (dead), Fauna 7, p. 42; field mice, Bul. 31, pp. 46, 47, 48; Ybk. 1905, pp. 371, 372; jackrabbit, Bul. 8, p. 44; pocket gopher, Bul. 5, pp. 20–21; Ybk. 1909, p. 217; (dead) Fauna 7, p. 42; spermophiles, Bul. 4, p. 16.

Food of nestlings, Ybk. 1900, p. 430.

Formal report, Bul. 3, pp. 11, 13–14, 132–139 (39 stomachs); Rept. 1887, p. 417 (7 stomachs).

Relation to orchards, Ybk. 1900, p. 301.

Amazilia graysoni, see Amizilis graysoni.

Amizilis graysoni — Grayson's humming bird.

Insect food and feeding habits, Fauna 14, p. 45.

Amazona oratrix — Double yellow-headed parrot.

Feeds on pods of *Pithecolobium dulce* and other fruits, Fauna 14, pp. 39–40.

Ammodramus caudacutus, see Passerherbulus caudacutus.

Ammodramus henslowi, see Passerherbulus henslowi.

Ammodramus maritimus, see Passerherbulus maritimus.

Ammodramus nelsoni, see Passerherbulus nelsoni.

Ammodramus savannarum australis—Grasshopper sparrow.

Feeding on weed seeds, Ybk. 1898, pp. 222, 223, 226, 227, 228.

Food at Marshall Hall, Bul. 17, pp. 13, 14, 26, 30, 32, 35, 38, 40, 44, 49, 70, 71, 72, 73, 97, 110 (10 stomachs).

Food of adults and nestlings, Ybk. 1900, p. 419.

Formal report, Bul. 15, pp. 21, 23, 24, 28, 34, 45, 61–63, 91, 92 (170 stomachs).

Ammodramus savannarum passerinus, see Ammodramus savannarum australis.

Ampelis cedrorum, see Bombycilla cedrorum.

Ampelis garrulus, see Bombycilla garrula.

Anas boschas, see Anas platyrhynchos.

Anas obscura, see Anas rubripes.

Anas platyrhynchos—Mallard.

Brief account, Bul. 38, p. 17.

Feeding on grasshoppers, Fauna 7, p. 15.

Food of nestlings, Ybk. 1900, p. 435.

Vegetable food, Circ. 81, pp. 1, 2, 8.

Anas rubripes—Black duck.

Vegetable food, Circ. 81, pp. 1, 2, 8.

Anhinga anhinga—Water-turkey.

Harmless, Bul. 38, p. 15.

Anthus pensylvanicus, see Anthus rubescens.

Anthus rubescens—Pipit.

Brief account, Bul. 38, p. 84.

Feeding on boll weevil, Bul. 22, pp. 8–9, 16; Bul. 25, pp. 9, 14, 21; Bul. 29, pp. 6, 22–23, 30; Bul. 38, pp. 9, 84; Circ. 57, p. 4; Circ. 64, pp. 4, 5; Rept. 1908, p. 576.

Antrostomus carolinensis — Chuck-will's-widow.

Brief account, Bul. 38, p. 50.

Antrostomus vociferus—Whippoorwill.

Brief account, Bul. 38, p. 50.

Food at Marshall Hall, Bul. 17, p. 19.

Aphelocoma californica—California jay.

Brief account, F. Bul. 54 (rev.), pp. 19–21 (141 stomachs).

Feeding on scale insects, Ybk. 1906, p. 194.

Food in California, Bul. 34, pp. 8, 47, 50–56 (326 stomachs).

Relation to fruit in California, Bul. 30, p. 13; Rept. 1901, p. 153; Ybk 1904, pp. 246, 248–250.

Aphelocoma woodhousei—Woodhouse's jay.

Feeding on piñon nuts, Fauna 3, pp. 39, 94.

Aquila chrysaëtos—Golden eagle.

Brief account, Circ. 61, pp. 3, 13, 14; Rept. 1887, p. 413; Ybk. 1894, pp. 217, 227.

Compiled information, Bul. 27, pp. 20–31.

Equally beneficial and injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Feeding on Abert's squirrel (*Sciurus aberti*), Fauna 3, p. 90; Beechey's spermophile (*Citellus beecheyi*), Circ. 76, pp. 7, 8; dusky grouse (probably), Fauna 7, p. 39; jack rabbits, Bul. 8, p. 44; (*Lepus texianus*) Fauna 25, p. 154; lambs of mountain sheep (probably), Fauna 30, p. 60; prairie dogs (watching for), Fauna 3, p. 90; rabbits, Ybk. 1907, p. 336; spermophiles, Bul. 4, p. 16; varying hares, Fauna 27, p. 359; woodchucks (probably), Fauna 7, p. 39; (*Marmota monax canadensis*) Fauna 27, p. 359.

Formal report, Bul. 3, pp. 15, 93–97 (6 stomachs).

Protected in some States, Ybk. 1899, p. 266.

Archibuteo ferrugineus—Squirrel hawk.

Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.

Brief account, Bul. 3, pp. 11, 91–93; Circ. 61, pp. 3, 4–6; Ybk. 1894, pp. 217, 219, 220.

Feeding on brown rat, Bul. 33, p. 34; rabbits, Ybk. 1907, p. 336; spermophiles, Bul. 4, pp. 15, 16.

Other notes, Bul. 31, p. 44.

- Archibuteo lagopus lagopus—Old-world rough-legged hawk.
  - Feeding on field mice, Bul. 31, p. 44.
- Archibuteo lagopus sancti-johannis—Rough-legged hawk.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 31, p. 44; Circ. 61, pp. 3, **4–5**; Ybk. 1894, pp. 217, **219–220**; Ybk. 1900, p. 301.
  - Feeding on brown rat, Bul. 33, p. 34; field mice, Bul. 31, p. 44; Ybk. 1905, p. 371; (*Microtus montanus*) F. Bul. 352, p. 22; ground squirrel (*Citellus plesius*, probably), Fauna 30, p. 88; rabbits, Ybk. 1907, p. 336.
  - Formal report, Bul. 3, pp. 11, **86–91**, 92 (49 stomachs); Rept. 1887, p. 413 (28 stomachs).
  - Relation to orchards, Ybk. 1900, p. 301.
- Archilochus colubris—Ruby-throated humming bird.
  - Food at Marshall Hall, Bul. 17, pp. 19, 39, **91**.
  - Food of adults and nestlings, Ybk. 1900, p. 427.
- Ardea cærulea, see Florida cærulea.
- Ardea candidissima, see Egretta candidissima.
- Ardea herodias—Great blue heron.
  - Brief account, Bul. 38, p. 25; Ybk. 1908, p. 193.
  - Feeding on field mice, Bul. 31, p. 52; Ybk. 1909, p. 217; pocket gophers, Ybk. 1908, p. 193; Ybk. 1909, p. 217.
  - Food at Marshall Hall, Bul. 17, pp. 19, 53.
  - Injurious to fish, exempted from protection in Vermont, Bul. 12 (rev.), p. 43.
- Ardea virescens, see Butorides virescens.
- Ardetta exilis, see Ixobrychus exilis.
- Arenaria interpres—Turnstone.
  - Feeding on beetles and other insects, Fauna 27, p. 336; crowberries, Ybk. 1903, p. 377; grasshoppers, Circ. 79, p. 2.
  - Feeds on caterpillars and cutworms, protected in Hawaii, Bul. 12 (rev.), p. 87.
- Arquatella maritima—Purple sandpiper.
  - Feeding on Nereis, Circ. 79, p. 8.
  - Food of adults and nestlings, Ybk. 1900, p. 432.
- Asio accipitrinus, see Asio flammeus.
- Asio flammeus—Short-eared owl.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670;
  - Brief account, Bul. 31, pp. 47, 48, 53; Circ. 61, pp. 3, **11**; Ybk. 1894, pp. 217, **224–225**.
  - Feeding on cotton rat (*Sigmodon hispidus texianus*), Fauna 25, p. 117; field mice, Bul. 31, pp. 47, 48, 53; Ybk. 1905, pp. 371, 372; (*Microtus drummondi*) Fauna 27, p. 368; mice, Fauna 19, p. 76; rabbits, Ybk. 1907, p. 336; shrews, Fauna 19, p. 76.
  - Food at Marshall Hall, Bul. 17, pp. 54–55, **86**.
  - Formal report, Bul. 3, pp. 11, 14, **145–149** (101 stomachs); Rept. 1887, 418 (45 stomachs); Rept. 1888, pp. 496–498 (50 stomachs).
- Asio otus—Old-world long-eared owl.
  - Brief account, feeding on field mice, Bul. 31, pp. 47, 48.
- Asio wilsonianus—American long-eared owl.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
  - Brief account, Bul. 31, pp. 47, 48; Bul. 38, pp. 41–42; Circ. 61, pp. 3, **11**; Ybk. 1894, pp. 217, **224**; Ybk. 1900, p. 430.
  - Feeding on field mice, Bul. 31, pp. 47, 48; Ybk. 1905, p. 371, (*Microtus drummondi*) Fauna 27, p. 367; rabbits, Ybk. 1907, p. 336; red-backed mice (*Evotomys dawsoni*), Fauna 27, p. 367.
  - Formal report, Bul. 3, pp. 11, 14, **140–145, 165** (107 stomachs); Rept. 1887, pp. 417–418 (47 stomachs).
- Astragalinus psaltria hesperophilus—Green-backed goldfinch.
  - Feeding on seeds of wild sunflower, Fauna 7, p. 84.
  - Food in California, Bul. 34, pp. **73–75**, 85 (476 stomachs).
- Astragalinus tristis—Goldfinch.
  - Brief account, Bul. 38, p. 61.
  - Damage to oats, Bul. 15, p. 11.
  - Feeding on mulberries, Rept. 1890, p. 285; weed seeds, Bul. 15, pp. 39, 42; Ybk. 1898, pp. 222, 224, 225, 229, 232.
  - Food at Marshall Hall, Bul. 17, pp. 14–15, 26, 69, 71, 75–76, 79, **97** (11 stomachs).
  - Food in California, Bul. 34, pp. **71–73**, 85 (84 stomachs); [also in East, p. 71].
- Astur atricapillus—Goshawk.
  - Brief account, Circ. 61, pp. 3, **17**; Ybk. 1894, pp. 218, **231**; Ybk. 1900, p. 429.
  - Feeding on bobwhite, Bul. 21, p. 22; ground squirrel (probably), Fauna 19, p. 73; poultry, Bul. 21, p. 22; Fauna 5, p. 94; ptarmigan, Fauna 27, p. 354; (*Lagopus lagopus*) Fauna 27, p. 346; rabbits, Ybk. 1907, p. 336; ruffed grouse, Bul. 24, p. 28; Fauna 27, p. 354; squirrel (*Sciurus*), Fauna 21, p. 76; varying hare, Fauna 27, p. 353.
  - Formal report, Bul. 3, pp. 15, **43–46**, 175 (28 stomachs); Rept. 1887, 405 (6 stomachs).

Astur atricapillus—Continued.

Injurious, Bul. 12, pp. 30, 49; Bul. 12 (rev.), pp. 33, 58; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670; Ybk. 1908, p. 192.

Other notes, Fauna 5, pp. 18, 94.

Asturina plagiata—Mexican goshawk.

Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Brief account, Bul. 3, pp. 11, 85–86.

Asyndesmus lewisi—Lewis's woodpecker.

Feeding on grasshoppers, Fauna 7, p. 50.

Food in California, Bul. 34, pp. 28–29 (23 stomachs).

Formal report, Bul. 37, pp. 10, 45–47 (59 stomachs).

Asyndesmus torquatus, see Asyndesmus lewisi.

Auklet, Paroquet, see Phaleris psittacula.

Avocet, see Recurvirostra americana.

B.

Bæolophus atricristatus—Black-crested titmouse.

Feeding on boll weevil, Bul. 22, pp. 9, 16; Bul. 25, pp. 9, 14, 15, 21; Bul. 29, pp. 6, 22, 30; Circ. 64, p. 5.

Bæolophus bicolor—Tufted titmouse.

Brief account, Bul. 38, p. 89; F. Bul. 54 (rev.), p. 44 (a mere reference).

Feeding on boll weevil, Bul. 29, pp. 6, 22, 28, 30; Circ. 64, pp. 4, 5; scale insects, Ybk. 1906, p. 197.

Food habits at Marshall Hall, Bul. 17, pp. 20, 61, 107.

Bæolophus inornatus—Plain titmouse.

Feeding on noxious insects. Ybk. 1904, p. 253; scale insects. Ybk. 1906, p. 194.

Food in California, Bul. 30, pp. 68–70 (76 stomachs).

Bæolophus wollweberi—Bridled titmouse.

Feeding on scale insects, Ybk. 1906, p. 197.

Baldpate, see Mareca americana.

Bartramia longicauda—Upland plover.

Brief account, Bul. 38, pp. 31–32.

Economic value, Bul. 22, pp. 15–16; Circ. 79, p. 6.

Feeding on billbugs, Circ. 79, p. 6; boll weevil, Bul. 29, pp. 6, 7, 11, 20, 29, 30; Bul. 38, p. 32; Circ. 64, pp. 2, 5; Circ. 79, p. 6; click beetles, clover leaf weevil, clover root weevil, corn-leaf beetle, cotton worm, cotton cutworm, cowpea weevil, Circ. 79, p. 6; crane flies, Circ. 79, p. 4; crayfishes, cutworms, grapevine colaspis, Circ. 79, p. 6; grasshoppers, Circ. 79, p. 2; Fauna 27, p. 328; wireworms, Circ. 79, p. 6.

Bee martin, see Tyrannus tyrannus.

Bengalee, see Uroloncha acuticauda.

Bittern, see Botaurus lentiginosus.

Least, see Ixobrychus exilis.

Blackbird, Bicolored redwing, see Agelaius gubernator californicus.

Boat-tailed, see Megaquiscalus major.

Brewer's, see Euphagus cyanocephalus.

Crow, see Quiscalus quiscula.

European, see Turdus merula.

Redwing, see Agelaius phœniceus.

Rusty, see Euphagus carolinus.

Tricolored redwing, see Agelaius tricolor.

Yellow-headed, see Xanthocephalus xanthocephalus.

Blackjack, see Marila collaris.

Bluebill, Big, see Marila marila.

Little, see Marila affinis.

Bluebird, see Sialia sialis.

Mountain, see Sialia currucoides.

Western, see Sialia mexicana occidentalis.

Bobolink, see Dolichonyx oryzivorus.

Bobwhite, see Colinus virginianus.

Masked, see Colinus ridgwayi.

Bombycilla cedrorum—Cedar bird.

Brief account, Bul. 38, p. 72; F. Bul. 54, pp. 31–32 (152 stomachs); F. Bul. 54 (rev.), pp. 38–39 (152 stomachs); Ybk. 1900, p. 304.

Feeding on cherries, Bul. 32, p. 91; Bul. 34, p. 55; Ybk. 1907, p. 175; grape (*Vitis californica*), Fauna 7, p. 113; insects, Fauna 27, p. 459; mahaleb cherry (*Prunus mahaleb*), Bul. 32, p. 65; mulberries, Bul. 32, pp. 64, 65; Fauna 7, p. 113; Rept. 1890, p. 285; scale insects, Ybk. 1906, p. 197.

Food at Marshall Hall, Bul. 17, pp. 17, 23, 24, 30, 43, 56, 59, 60, 62, 99 (5 stomachs).

Food of nestlings, Ybk. 1900, pp. 417, 436.

Formal report, Rept. 1892, pp. 197–200 (125 stomachs).

Frugivorous habits (other than above noted), Bul. 30, p. 20; Rept. 1890, p. 281.

Reference to studies of food habits, Ybk. 1899, p. 266.

Relation to orchards, Ybk. 1900, p. 304.

Bombycilla garrula—Bohemian waxwing.

Feeding on berries and insects, Fauna 19, p. 89.

Bonasa umbellus—Ruffed grouse.

Brief account, Ybk. 1909, p. 194.

Feeding on buds, Ybk. 1907, p. 172; of balsam poplar, Fauna 27, pp. 340, 342; of *Lepargyrea* and *Salix*, Fauna 27, pp. 341, 342; catkins of willows, Fauna 27, p. 341; foliage, Bul. 21, p. 52; of *Populus balsam-*

Bonasa umbellus—Continued.

ifera and *Pyrola*, Fauna 27, p. 342; of willow, Fauna 27, 341; grass seeds, Fauna 27, p. 341; heads and shoots of *Equisetum*, Fauna 27, pp. 341, 342; potato beetle, Bul. 32, p. 47; rose hips, Fauna 27, p. 341; weed seeds, Ybk. 1898, p. 231.

Formal report, Bul. 24, pp. 17, 23, 25–38 (208 stomachs).

Booby, Blue-footed, see Sula nebouxi.

Botaurus lentiginosus—Bittern.

Brief account, Bul. 38, p. 24; Ybk. 1908, p. 193.

Feeding on field mice, Bul. 31, p. 52; frogs and large beetles, Fauna 27, p. 311; injurious rodents, Ybk. 1908, p. 193.

Branta canadensis—Canada goose.

Brief account, Bul. 38, p. 23.

Feeding on berries of *Empetrum nigrum*, Fauna 27, p. 306.

Bubo virginianus—Great horned owl.

Bounty laws, Ybk. 1899, p. 281.

Brief account, Bul. 31, p. 49; Bul. 38, pp. 43–44; Circ. 61, pp. 3, 13, 15–16, 18; Ybk. 1894, pp. 217, 227, 229; Ybk. 1900, pp. 300–301, 430.

Equally beneficial and injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Feeding on brown bat (*Vespertilio fuscus*), Fauna 25, p. 211; brown rat, Bul. 33, p. 35; field mice, Bul. 31, p. 49; Fauna 5, pp. 19, 96; Ybk. 1905, p. 371; Ybk. 1908, p. 188; (*Microtus drummondi*) Fauna 27, pp. 372, 374; ground squirrels, Fauna 19, p. 76; jack rabbits, Bul. 8, p. 44; (*Lepus texianus*) Fauna 25, p. 154; lemming mouse (*Phenacomys orophilus*), Fauna 5, pp. 19, 96; pocket gophers, Bul. 5, pp. 20–21; (*Cratogeomys castanops*) Fauna 25, p. 133; (*Thomomys*) Fauna 5, pp. 19, 96; poultry, Bul. 2, p. 122; Bul. 21, p. 22; rabbits, Bul. 2, p. 122; Fauna 19, p. 76; Ybk. 1900, pp. 300–301; Ybk. 1907, p. 336; Ybk. 1908, p. 188; (*Lepus arizonæ minor*) Fauna 25, p. 159; red squirrels, Fauna 19, p. 76; (*Sciurus hudsonicus*) Fauna 27, p. 372; ruffed grouse, Bul. 24, p. 28; scorpion, Fauna 7, p. 43; shrews (*Sorex personatus*), Fauna 27, p. 372; skunks, Bul. 2, p. 122; (*Spilogale leucoparia*) Fauna 25, p. 198; spermophiles, Bul. 4, pp. 16–17; varying hares (*Lepus americanus*), Fauna 27, pp. 373, 374; water beetles (*Dytiscus dauricus*), Fauna 27, p. 373; white-footed mice, Fauna 5, pp. 19, 96; (*Peromyscus arcticus*) Fauna 27, p. 372; wood rats (*Neotoma*), Fauna 7, p. 43; (*Neotoma micropus*) Fauna 25, p. 112.

Bubo virginianus—Continued.

Food at Marshall Hall, Bul. 17, pp. 19, 52, 54, 86, 110.

Food of nestlings, Ybk. 1900, pp. 430–431.

Formal report, Bul. 3, pp. 15, 174–182 (127 stomachs); Rept. 1887, pp. 402, 421 (30 stomachs).

Injurious, Bul. 12, pp. 30, 36, 49; Bul. 12 (rev.), pp. 32, 33, 43, 58; Ybk. 1907, p. 167.

Other notes, Fauna 5, p. 18.

Relation to orchards, Ybk. 1900, pp. 300–301.

Bufflehead, see Charitonetta albeola.

Bunting, Indigo, see Passerina cyanea.

Painted, see Passerina ciris.

Snow, see Plectrophenax nivalis.

Yellow, see Emberiza citrinella.

Bush tit, see Psaltriparus minimus.

Butcher bird, Big, see Lanius borealis.

European great, see Lanius excubitor.

Little, see Lanius ludovicianus.

Buteo abbreviatus—Zone-tailed hawk.

Formal report, Bul. 3, p. 71 (5 stomachs).

Buteo albicaudatus sennetti — Sennett's white-tailed hawk.

Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Brief account, Bul. 3, pp. 11, 72.

Feeding on rabbits, Ybk. 1907, p. 336.

Buteo borealis—Red-tailed hawk.

Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Brief account, Bul. 31, p. 43; Bul. 38, p. 38; Circ. 61, pp. 3, 6–7; Rept. 1888, p. 480; Ybk. 1894, pp. 217, 220–221; Ybk. 1900, p. 429.

Feeding on brown rat, Bul. 33, p. 34; chipmunks (*Tamias cinereicollis* and *T. lateralis*), Fauna 3, p. 90; dove (attempt to pick up wounded one), Fauna 7, p. 37; field mice, Bul. 31, p. 43; Ybk. 1905, p. 371; Ybk. 1908, p. 187; (*Microtus montanus*) F. Bul. 352, p. 22; grasshoppers, Bul. 3, p. 76; Fauna 7, p. 37; ground squirrel, Fauna 19, p. 73; horned larks, Bul. 23, p. 12; jack rabbits, Bul. 8, p. 44; Jerusalem cricket (*Stenopelmatus*), lizards (*Cnemidophorus tigris* and *Sauromalus ater*), Fauna 7, p. 37; (iguanas) Fauna 14, p. 37; pocket gophers, Bul. 5, p. 20; (*Thomomys*) Fauna 7, p. 37; potato beetle, Bul. 32, p. 47; rabbits, Ybk. 1907, p. 336; (*Lepus graysoni*) Fauna 14, pp. 17, 37; spermophiles, Bul. 4, pp. 15, 16, 17; (*Spermophilus tereticaudus*) Fauna 7, p. 37; (*Spermophilus townsendi*) Fauna 5, p. 94; squirrel

- Buteo borealis—Continued.
  - (*Sciurus aberti*), Fauna 3, p. 90; varying hares (apparently), Fauna 27, p. 356.
  - Food at Marshall Hall, Bul. 17, pp. 19, 54.
  - Food of nestlings, Ybk. 1900, p. 429.
  - Formal report, Bul. 3, pp. 11, 12, 48–62, 87 (562 stomachs); Rept. 1887, pp. 405–410 (311 stomachs).
- Buteo brachyurus—Short-tailed hawk.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 3, pp. 11, 83–84.
- Buteo buteo—Common old-world buzzard hawk.
  - Feeding on field mice, Bul. 31, p. 44.
- Buteo latissimus, see Buteo platypterus.
- Buteo lineatus—Red-shouldered hawk.
  - Beneficial, Bul. 12, p. 30; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
  - Brief account, Bul. 12, p. 30; Bul. 12 (rev.), p. 33; Bul. 31, p. 43; Bul. 38, p. 39; Circ. 61, pp. 3, 6, 7–8; Ybk. 1894, pp. 217, 220, 221; Ybk. 1900, p. 429.
  - Feeding on brown rat, Bul. 33, p. 34; field mice, Bul. 31, p. 43; Ybk. 1905, p. 371; frogs (watching for), Fauna 7, p. 38; horned larks, Bul. 23, p. 12; rabbits, Ybk. 1907, p. 336; ruffed grouse, Bul. 24, p. 28.
  - Food at Marshall Hall, Bul. 17, pp. 19, 54, 86.
  - Formal report, Bul. 3, pp. 11, 12, 62–70 (220 stomachs); Rept. 1887, pp. 410–412 (102 stomachs).
- Buteo platypterus—Broad-winged hawk.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 31, p. 43; Bul. 38, p. 39; Circ. 61, pp. 3, 9; Ybk. 1894, pp. 217, 222–223.
  - Feeding on brown rat, Bul. 33, p. 34; field mice, Bul. 31, p. 43; Ybk. 1905, p. 371.
  - Food at Marshall Hall, Bul. 17, pp. 19, 32, 86, 101.
  - Food of nestlings, Ybk. 1900, p. 429.
  - Formal report, Bul. 3, pp. 11, 13, 79–83 (65 stomachs); Rept. 1887, pp. 412–413 (22 stomachs).
- Buteo swainsoni—Swainson's hawk.
  - Beneficial, Bul. 12, p. 30; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
  - Brief account, Bul. 12, p. 30; Bul. 12 (rev.), p. 33; Bul. 31, p. 43; Circ. 61, pp. 3, 8–9; Ybk. 1894, pp. 217, 222.
  - Feeding on brown rat, Bul. 33, p. 34; field mice, Bul. 31, p. 43; (*Microtus montanus*) F. Bul. 352, p. 22; grasshoppers, Fauna 5, p. 95; Ybk. 1895, p. 422; Ybk. 1907, p. 166; (*Camnula pellucida*) Fauna 7, p. 38; rabbits, Ybk. 1907, p. 336; spermophiles, Bul. 4, pp. 15, 16, 17.
  - Formal report, Bul. 3, pp. 11, 12, 13, 72–79 (18 stomachs); Rept. 1887, p. 412 (4 stomachs).
- Butorides virescens—Green heron.
  - Brief account, Bul. 38, p. 26.
  - Food at Marshall Hall, Bul. 17, pp. 19, 23, 24, 53, 81.
  - Food of nestlings, Ybk. 1900, p. 435.
  - Injurious to fish, exempt from protection in Alabama and Pennsylvania, Bul. 12, p. 36; Bul. 12 (rev.), p. 43.
- Buzzard, Black, see Catharista urubu.
  - Turkey, see Cathartes aura septentrionalis.
- Buzzard hawk, Common, see Buteo buteo.
  - Rough-legged, see Archibuteo lagopus lagopus.

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- Calcarius lapponicus—Lapland longspur.
  - Feeding on weed seeds, Ybk. 1898, p. 226.
  - Formal report, Bul. 15, pp. 45, 54–55 (113 stomachs).
- Calcarius ornatus—Chestnut-collared longspur.
  - Feeding on weed seeds, Ybk. 1898, p. 226.
  - Pulling wheat, Bul. 23, p. 16.
- Calcarius pictus—Smith's longspur.
  - Feeding on weed seeds, Ybk. 1898, p. 226.
- Callipepla squamata—Scaled quail.
  - Formal report, Bul. 21, pp. 61–63 (47 stomachs).
- Campephilus principalis—Ivory-billed woodpecker.
  - Brief account, Bul. 37, pp. 62–63.
  - Useful, Bul. 38, p. 46.
- Canachites canadensis—Spruce grouse.
  - Feeding on bearberries (*Arctostaphylos uva-ursi*), Fauna 27, p. 338; blueberries, Fauna 21, p. 75; (*Vaccinium uliginosum*), fern (*Cryptogramma acrostichoides*), Fauna 27, p. 338; heads of Equisetum, Fauna 21, p. 75; highbush cranberries (*Viburnum*), Fauna 21, p. 75; Fauna 30, p. 86; mountain cranberries (*Vitis-idæa vitis-idæa*), Fauna 24, p. 65; Fauna 27, p. 338; pine needles (*Pinus divaricata*), snails (*Lymnæa palustris*), Fauna 27, p. 338; spruce needles, Fauna 21, p. 75; Fauna 24, p. 65; (*Picea canadensis*) Fauna 27, p. 338.
  - Formal report, Bul. 24, pp. 38–40, 42 (8 stomachs).
- Canachites franklini—Franklin's grouse.
  - Brief account, Bul. 24, p. 40.
- Canvasback, see Marila valisineria.

- Capercaillie, see Tetrao urogallus.
- Caracara, see Polyborus cheriway.
- Carancho, see Polyborus tharus.
- Cardinalis cardinalis—Cardinal.
  - Brief account, Bul. 38, p. 67; F. Bul. 456. pp. 9, 12.
  - Feeding on boll weevil, Bul. 25, pp. 9, 12, 20–21; Bul. 29, pp. 6, 19, 26, 30; Circ. 64, p. 5; fruit seeds, Bul. 15, pp. 74, 88; potato beetle, Bul. 32, p. 47; scale insects, Ybk. 1906, p. 192; weed seeds, Bul. 15, pp. 38–39; Ybk. 1898, p. 230.
  - Food at Marshall Hall, Bul. 17, pp. 18, 21, 24, 25, 30, 31, 32, 34, 35, 38, 59, 60, 61, 62, 70, 71, 77, 98 (10 stomachs).
  - Formal report, Bul. 32, pp. 5–27, 28, 90, 91 (498 stomachs).
- Carpodacus mexicanus frontalis—House finch.
  - Brief account, F. Bul. 54 (rev.), pp. 33–34 (987 stomachs); Ybk. 1900, pp. 302–303.
  - Damaging fruit, Rept. 1900, p. 47; Rept. 1901, p. 153; peaches, Fauna 7, pp. 80, 81.
  - Feeding on cherries, Bul. 34, p. 55; weed seeds, Bul. 34, p. 85.
  - Food in California, Bul. 30, pp. 12, 13–23, 86 (1,206 stomachs).
  - Injurious, Bul. 34, p. 8; Rept. 1900, p. 47; Rept. 1901, p. 153; Ybk. 1898, p. 107.
  - Relation to fruit in California, Ybk. 1904, pp. 245, 246–248.
  - Relation to orchards, Ybk. 1900, pp. 302–303.
- Carpodacus purpureus—Purple finch.
  - Brief account, Bul. 38, p. 61; Ybk. 1900, p. 302.
  - Feeding on buds, Ybk. 1907, p. 173; climbing false buckwheat, Bul. 15, p. 42; mulberries, Rept. 1890, p. 285; ragweed, Bul. 15, p. 42.
  - Food at Marshall Hall, Bul. 17, pp. 20, 62, 76–77, 97.
  - Relation to orchards, Ybk. 1900, p. 302; Ybk. 1907, p. 173.
- Catarina, see Psittacula insularis.
- Catbird, see Dumetella carolinensis.
- Catharista atrata, see Catharista urubu.
- Catharista urubu—Black buzzard.
  - Brief account, Bul. 38, p. 36.
  - Feeding on carrion, Bul. 2, p. 110; Rept. 1888, p. 524.
  - Protected on account of useful feeding habits, Bul. 12, p. 29; Bul. 12 (rev.), p. 32.
- Cathartes aura septentrionalis—Turkey buzzard.
  - Brief account, Bul. 38, p. 36.
  - Feeding on carrion, Bul. 2, p. 110; Circ. 76, pp. 9–10; Fauna 7, pp. 33, 34; Fauna 25, p. 201; Rept. 1888, p. 524.
- Cathartes aura septentrionalis—Continued.
  - Food at Marshall Hall, Bul. 17, pp. 19, 53–54, 85.
  - Food of young in captivity, Ybk. 1900, p. 431.
  - Protected on account of useful feeding habits, Bul. 12, p. 29; Bul. 12 (rev.), p. 32.
- Catherpes mexicanus punctulatus—Dotted cañon wren.
  - Brief account, Bul. 30, pp. 65–66.
- Cedar bird, see Bombycilla cedrorum.
- Centrocercus urophasianus—Sage hen.
  - Brief account, Bul. 24, pp. 23–25.
  - Flesh favored with sage, Fauna 5, p. 93.
- Centurus aurifrons—Golden-fronted woodpecker.
  - Brief account, Bul. 37, pp. 63, 64.
  - Damage to poles, Bul. 39, p. 10.
- Centurus carolinus—Red-bellied woodpecker.
  - Brief account, Bul. 38, p. 48.
  - Damage to buildings, Bul. 39, p. 13; poles, Bul. 39, p. 11.
  - Formal report, Bul. 7, pp. 8, 10, 11, 23, 25–27 (22 stomachs); Bul. 37, pp. 10, 43, 47–52 (271 stomachs).
  - Reference to vegetarian tastes, Bul. 34, p. 23.
  - Relation to orchards, Ybk. 1900, p. 295.
- Centurus uropygialis—Gila woodpecker.
  - Brief account, Bul. 37, pp. 63, 64.
  - Damage to poles, Bul. 39, pp. 10, 11.
- Ceophlœus pileatus, see Phlœotomus pileatus.
- Certhia familiaris americana—Brown creeper.
  - Brief notes, Bul. 38, p. 88; Ybk. 1908, p. 346.
  - Feeding on scale insects, Ybk. 1906, p. 197.
  - Food at Marshall Hall, Bul. 17, pp. 32, 34, 35, 107.
  - Relation to orchards, Ybk. 1900, pp. 296–297.
- Certhia familiaris familiaris—Tree creeper.
  - Feeding on scale insects, Ybk. 1906, p. 191.
- Certhia familiaris occidentalis—California creeper.
  - Feeding on codling moth, Bul. 34, pp. 17, 70.
  - Food in California, Bul. 30, p. 66 (7 stomachs).
- Ceryle alcyon—Belted kingfisher.
  - Brief account, Bul. 38, p. 45; Ybk. 1900, p. 428.
  - Feeding on eelpout (*Lota maculosa*), Fauna 27, p. 378.
  - Food at Marshall Hall, Bul. 17, pp. 19, 53, 87–88 (5 stomachs).
  - Food of nestlings, Ybk. 1900, pp. 411, 428.

- Ceryle alcyon—Continued.
  - Injurious to fish, exempt from protection in certain States, Bul. 12, pp. 36, 37; Bul. 12 (rev.), p. 43.
- Chæmepelia passerina terrestris—Ground dove.
  - Feeding on weed seeds, Ybk. 1898, p. 232.
- Chætura pelagica—Chimney swift.
  - Feeding on mosquitoes, Bul. 38, p. 9; Rept. 1908, p. 577.
  - Food at Marshall Hall, Bul. 17, pp. 24, 25, 35, 39, 40, 91.
  - Insectivorous, Bul. 38, p. 9.
- Chaffinch, see Fringilla cœlebs.
- Chamæa fasciata—Wren tit.
  - Feeding on scale insects, Ybk. 1906, pp. 194, 195.
  - Food in California, Bul. 30, pp. 71–74 (165 stomachs).
- Charadrius dominicus—Golden plover.
  - Feeding on crowberries (*Empetrum nigrum*), Fauna 27, pp. 332, 333; Ybk. 1903, p. 377; grasshoppers, Circ. 79, p. 2.
  - Feeds on caterpillars and cutworms, protected in Hawaii, Bul. 12 (rev.), p. 87.
- Charitonetta albeola—Bufflehead.
  - Vegetable food, Circ. 81, p. 1.
- Chat, yellow-breasted, see Icteria virens.
- Chaulelasmus streperus—Gadwell.
  - Brief account, Bul. 38, p. 18.
  - Vegetable food, Circ. 81, p. 1.
- Chelidon erythrogaster, see Hirundo erythrogastra.
- Chelidon urbica, see Chelidonaria urbica.
- Chelidonaria urbica—Old-world martin.
  - Value as insect destroyer, Bul. 1, pp. 330, 332, 333, 336, 346; Rept. 1886, p. 244.
- Chen hyperboreus—Snow goose.
  - Feeding on club-rush, Fauna 7, p. 18; crowberries (*Empetrum nigrum*), Fauna 27, pp. 298, 301.
- Chickadee, Black-capped, see Penthestes atricapillus.
  - Carolina, see Penthestes carolinensis.
  - Chestnut-backed, see Penthestes rufescens.
  - Mountain, see Penthestes gambeli.
- Chloris chloris—Greenfinch.
  - Economic status, introduction dangerous, etc., Ybk. 1898, pp. 90, 106, 107, 109.
  - Feeding on caterpillars and corn, Bul. 1, p. 343.
- Chondestes grammacus—Lark sparrow.
  - Brief account, Bul. 38, p. 63.
  - Feeding on boll weevil, Bul. 25, pp. 9, 12, 18, 21; Bul. 29, pp. 6, 19, 30; Circ. 64, p. 5; weed seeds, Ybk. 1898, pp. 226, 227, 228, 229.
- Chondestes grammacus—Continued.
  - Formal report, Bul. 15, pp. 24, 27, 28, 45, 66–68, 91, 92 (167 stomachs).
- Chordeiles acutipennis texensis — Texas nighthawk.
  - Feeding on *Ephydra hians*, Fauna 7, p. 53.
- Chordeiles virginianus—Nighthawk.
  - Brief account, F. Bul. 54 (rev.), pp. 13–14 (about 100 stomachs).
  - Feeding on boll weevil, Bul. 25, pp. 8, 9, 13, 20, 21; Bul. 29, pp. 6, 21, 25, 30; Bul. 38, pp. 9, 51; Circ. 57, pp. 1, 4; Circ. 64, p. 5; Rept. 1906, p. 404; mosquitoes, Bul. 38, p. 9; Rept. 1908, p. 577; potato beetle, Bul. 32, p. 47.
  - Food at Marshall Hall, Bul. 17, pp. 19, 33, 91.
  - Useful, Ybk. 1904, p. 514.
- Chuck-will's-widow, see Antrostomus carolinensis.
- Ciconia ciconia—White stork.
  - Feeding on field mice, Bul. 31, p. 53.
- Ciconia maguari, see Euxenura maguari.
- Circus hudsonius—Marsh hawk.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
  - Brief account, Bul. 31, p. 43; Bul. 38, p. 37; Circ. 61, pp. 3, 6; Ybk. 1894, pp. 217, 220; Ybk. 1900, pp. 301, 429.
  - Feeding on brown rat (probably), Bul. 33, p. 34; chipmunk (*Tamias minimus pictus*), Fauna 5, p. 94; cotton rat (*Sigmodon hispidus texianus*), Fauna 25, pp. 116, 117; field mice, Bul. 4, p. 15; Bul. 31, p. 43; Fauna 7, p. 35; Ybk. 1905, p. 371; horned larks, Bul. 23, p. 12; jackrabbits, Bul. 8, p. 44; pocket gophers, Bul. 5, p. 20; rabbits, Bul. 4, p. 15; Ybk. 1907, p. 336; spermophiles, Bul. 4, pp. 15, 16, 17; (*Spermophilus townsendi*), shrew (*Neosorex*), Fauna 5, p. 94; squirrels, Bul. 4, p. 15.
  - Food at Marshall Hall, Bul. 17, pp. 54, 55, 86.
  - Food of nestlings, Ybk. 1900, p. 429.
  - Formal report, Bul. 3, pp. 11, 12, 26–32, 134 (124 stomachs); Rept. 1887, pp. 403–404 (46 stomachs); Rept. 1889, pp. 370–372.
  - Relation to orchards, Ybk. 1900, p. 301.
- Cistothorus palustris, see Telmatodytes palustris.
- Clangula clangula americana—Golden-eye.
  - Vegetable food, Circ. 81, p. 1.
- Coccothraustes vespertina, see Hesperiphona vespertina.
- Coccyzus americanus—Yellow-billed cuckoo.
  - Beneficial, Ybk. 1897, p. 670; Ybk. 1904, p. 514.

- Coccyzus americanus—Continued.
  - Brief account, Bul. 1, p. 123; Bul. 38, p. 45; F. Bul. 54, pp. 5–6 (21 stomachs); F. Bul. 54 (rev.), pp. 7–8 (109 stomachs); Ybk. 1900, p. 297.
  - Feeding on caterpillars, Rept. 1889, p. 369; Rept. 1898, pp. 39–40; cotton worm, Bul. 25, pp. 19–20; mulberries, Rept. 1890, p. 285; potato beetle, Bul. 32, p. 47; Rept. 1889, p. 369; rose beetle, Bul. 32, p. 20; tussock moth, Bul. 1, pp. 108–109, 292, 324; Rept. 1886, p. 244; webworms, Bul. 1, p. 123.
  - Food at Marshall Hall, Bul. 17, pp. 24, 29, 30, **87**.
  - Formal report, Bul. 9, pp. 7–14 (109 stomachs).
  - Reference to studies of food habits, Ybk. 1899, p. 266.
  - Relation to orchards, Ybk. 1900, p. 297.
- Coccyzus erythropthalmus — Black-billed cuckoo.
  - Beneficial, Bul. 38, p. 45; Ybk. 1897, p. 670.
  - Brief account, F. Bul. 54, pp. 5–6 (16 stomachs); F. Bul. 54 (rev.), pp. 7–8 (46 stomachs); Ybk. 1900, pp. 297, 428.
  - Feeding on caterpillars, Rept. 1898, pp. 39–40; tussock moth, Bul. 1, pp. 108, 109; Rept. 1886, p. 244.
  - Food at Marshall Hall, Bul. 17, pp. 24, **87**.
  - Food of nestlings, Ybk. 1900, p. 428.
  - Formal report, Bul. 9, pp. 7–14 (46 stomachs).
  - Reference to studies of food habits, Ybk. 1899, p. 266.
  - Relation to orchards, Ybk. 1900, p. 297.
- Colaptes auratus—Flicker.
  - Beneficial, Ybk. 1897, p. **670**; Ybk. 1904, p. 514.
  - Brief account, Bul. 12, p. 18; Bul. 12 (rev.), p. 25; Bul. 34, p. 25; Bul. 38, pp. 48–49; F. Bul. 54, pp. 7–8, 10; F. Bul. 54 (rev.), pp. **10–11**, 13; Ybk. 1900, p. 294.
  - Damage to buildings, Bul. 39, pp. 13–14; poles, Bul. 39, p. 11; posts, Bul. 39, p. 13.
  - Distributing poison Rhus seeds, Rept. 1890, p. 283.
  - Feeding on ants, Fauna 27, p. 388.
  - Food at Marshall Hall, Bul. 17, pp. 19, 34, 38, 62, **90–91**.
  - Food of nestlings, Ybk. 1900, p. 427.
  - Formal report, Bul. 7, pp. 8, 9, 10, 11, **16–20**, 25, 38 (230 stomachs); Bul. 37, pp. 10, 12, **52–58**, 59, 60, 61 (684 stomachs).
  - Relation to orchards, Ybk. 1900, p. 294.
- Colaptes cafer collaris—Red-shafted flicker.
  - Brief account, F. Bul. 54, pp. 7–8; F. Bul. 54 (rev.), pp. 10–11.
  - Damage to buildings, Bul. 39, pp. 13–14; Fauna 7, p. 51; poles, Bul. 39, p. 11; posts, Bul. 39, pp. 13–14.
  - Feeding on juniper berries (probably), Fauna 16, p. 116.
  - Food in California, Bul. 34, pp. 25–28 (118 stomachs).
  - Formal report, Bul. 37, pp. 10, **59–62** (183 stomachs).
- Colaptes chrysoides—Gilded flicker.
  - Brief account, Bul. 37, pp. 63, **64**.
- Colinus ridgwayi—Masked bobwhite.
  - Brief account, Bul. 21, pp. 46–47.
- Colinus virginianus—Bobwhite.
  - Brief account, Bul. 38, pp. 9, 34; F. Bul. 54 (rev.), pp. 5–6; Ybk. 1900, p. 432; Ybk. 1909, p. 252.
  - Economic value, Bul. 38, p. 9; Rept. 1904, p. 294; Ybk. 1902, p. 206; Ybk. 1907, pp. 172, 594.
  - Feeding on boll weevil, Bul. 22, pp. 11–12, 16; Bul. 25, pp. 8, 13, 21; Bul. 29, pp. 6, 21, 30; Circ. 64, p. 5; garden pests, Circ. 81, p. 8; grain, Rept. 1898, p. 39; poison Rhus seeds, Rept. 1890, p. 283; potato beetle, Bul. 32, p. 47; seeds, Bul. 22, pp. 12, 13; weed seeds, Bul. 15, p. 37; Ybk. 1898, pp. 222, 231–232.
  - Food at Marshall Hall, Bul. 17, pp. 13, 22, 25, 26, 28, 32, 38, 40, 60, 62, 69–70, 71, **78**, **83–85**, 110, 111 (13 stomachs).
  - Food of nestlings, Ybk. 1900, p. 432.
  - Formal report, Bul. 21, pp. 9–46 (918 stomachs); Ybk. 1903, pp. 193–204 (801 stomachs).
  - Natural and valuable cultivated foods, Ybk. 1909, p. 194.
- Columba fasciata—Band-tailed pigeon.
  - Feeding on acorns and berries of *Arbutus menziesii*, Fauna 7, p. 31.
- Columba flavirostris madrensis—Tres Marias pigeon.
  - Feeding on figs and guavas, Fauna 14, p. 35.
- Columba livia—Common pigeon.
  - Feeding on army worms, Bul. 1, pp. 290–291.
- Columba palumbus—Wood pigeon.
  - Injurious in England, Bul. 1, p. 335.
- Colymbus auritus—Horned grebe.
  - Food at Marshall Hall, Bul. 17, p. 79.
- Compsothlypis americana—Parula warbler.
  - Brief account, Bul. 38, p. 77.
  - Food at Marshall Hall, Bul. 17, pp. 23, 24, 103–104.
- Condor, California, see Gymnogyps californianus.
- Contopus richardsoni, see Myiochanes richardsoni.
- Contopus virens, see Myiochanes virens.

Conuropsis carolinensis—Carolina paroquet.
  Brief account, Bul. 38, p. 44.
Coot, see Fulica americana.
Cormorant, Double-crested, see Phalacrocorax auritus.
Cormorant, Red-faced, see Phalacrocorax urile.
Corvus americanus, see Corvus brachyrhynchos.
Corvus brachyrhynchos—American crow.
  Bounty laws, Ybk. 1896, pp. 55, 57, 58, 59, 61; Ybk. 1899, pp. 279, 280, 281, 282.
  Brief account, Bul. 31, pp. 50–51; Bul. 38, p. 56; F. Bul. 54, pp. 3, **15–17**; F. Bul. 54 (rev.), pp. 3, **22–23**, 25; Ybk. 1897, pp. 345, 346–348; Ybk. 1900, p. 424; Ybk. 1907, pp. 170, 175, 177, 178.
  Damage to grain, Bul. 12, pp. 36, 37; Bul. 12 (rev.), p. 43; Rept. 1898, p. 39; Ybk. 1897, pp. 345, 346–348.
  Distributing poison Rhus, Rept. 1889, p. 368; and other seeds, Rept. 1890, pp. 282–284.
  Equally beneficial and injurious, Bul. 12, p. 49; Bul. 12 (rev.), p. 58.
  Feeding on corn, Bul. 3, p. 9; Bul. 32, p. 91; Rept. 1886, p. 242; cutworms, Bul. 3, p. 9; eggs and young of bobwhite, Bul. 21, p. 22; of ruffed grouse, Bul. 24, p. 28; of shorebirds, Circ. 79, p. 2; field mice, Bul. 31, pp. 50–51; Ybk. 1905, p. 371; (*Microtus montanus*) F. Bul. 335, p. 12; F. Bul. 352, p. 21; Ybk. 1908, p. 309; figs, Fauna 7, p. 72; insects, Ybk. 1908. p. 347; poison Rhus seeds, Bul. 24, p. 36; poisoned wheat, F. Bul. 352, p. 8; potato beetle, Bul. 32, p. 47.
  Food at Marshall Hall, Bul. 17, pp. 13–14, 23, 24, 28, 30, 32, 34, 35, 37, 38, 43, 47–48, **50**, 53, 54, 55, 56, **57–58**, 59, 60, 61, 62, **63–64**, **65–66**, 68, 84, 94, 110.
  Food of nestlings, Ybk. 1900, pp. 424–425, 436.
  Formal report, Bul. 6, pp. 1–98 (909 stomachs); Rept. 1888, pp. 498–534 (86 stomachs).
  Injurious, hence unprotected in certain States, Bul. 12, pp. 36, 37; Bul. 12 (rev.), p. 43; Bul. 38, p. 10.
  Other notes, Rept. 1890, p. 279.
  Predatory, F. Bul. 390, p. 23.
  Reference to studies of food, Ybk. 1899, pp. 265, 266.
  Request for information on economic relations, Ent. Circ. 20 [p. 1]; Circ. 1 [p. 2]; Rept. 1886, p. 230.
  Scalps paid in lieu of taxes, Ybk. 1896, p. 67.
Corvus caurinus—Northwestern crow.
  Feeding on field mice, Bul. 31, p. 50; pheasant eggs, Rept. 1888, p. 485.
Corvus corax corax—Old-world raven.
  Feeding on lemmings and voles, Bul. 31, p. 50.
Corvus corax principalis—Northern raven.
  Feeding on carrion, Fauna 24, p. 71; Fauna 30, pp. 40, 62, 90; crabs, Fauna 21, p. 47.
Corvus corax sinuatus—Southern raven.
  Feeding on carrion, Fauna 7, p. 71; field mice, Bul. 31, p. 50; (*Microtus montanus*) F. Bul. 335, p. 12; F. Bul. 352, p. 21; Rept. 1908, p. 573; Ybk. 1908, p. 309; grasshoppers, Fauna 7, pp. 38, 71.
Corvus corone—Carrion crow.
  Feeding on eggs and young of *Perdix perdix*, Bul. 6, p. 41; lemmings and voles, Bul. 31, p. 50.
Corvus cryptoleucus—White-necked raven.
  Feeding on field mice, Bul. 31, p. 50; pocket gophers (probably), Bul. 6, p. 35.
Corvus frugilegus—Rook.
  Feeding on lemmings and voles, Bul. 31, p. 50.
Corvus ossifragus—Fish crow.
  Brief account, Rept. 1888, pp. 498, 500, 515, 525, **534–535** (12 stomachs).
  Feeding on cultivated fruit, Bul. 6, p. 82; field mice, Bul. 31, p. 50; sumach seeds, Rept. 1890, pp. 283–284.
  Food at Marshall Hall, Bul. 17, pp. 14, 63.
Coturniculus savannarum passerinus, see Ammodramus savannarum australis.
Cowbird, see Molothrus ater.
Crane, Little brown, see Grus canadensis.
  Sandhill, see Grus mexicana.
  Whooping, see Grus americana.
Creeper, Black-and-white, see Mniotilta varia.
  Brown, see Certhia familiaris americana.
  California, see Certhia familiaris occidentalis.
  Tree, see Certhia familiaris familiaris.
Crossbill, see Loxia curvirostra minor.
  White-winged, see Loxia leucoptera.
Crow, American, see Corvus brachyrhynchos.
  Carrion, see Corvus corone.
  Clarke's, see Nucifraga columbiana.
  Fish, see Corvus ossifragus.
  Northwestern, see Corvus caurinus.
Cryptoglaux acadica—Saw-whet owl.
  Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  Feeding on field mice, Bul. 31, p. 50; Ybk. 1905, p. 371.
  Formal report, Bul. 3, pp. 11, **160–162** (22 stomachs); Rept. 1887, p. 419 (6 stomachs).

Cryptoglaux funerea richardsoni—Richardson's owl.
  Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  Brief account, Bul. 3, pp. 11, 159.
  Feeding on field mice (*Microtus drummondi*), red-back mice (*Evotomys gapperi athabascæ*), and white-footed mice (*Peromyscus arcticus*), Fauna 27, p. 370.
Cuckoo, Black-billed, see Coccyzus erythropthalmus.
    Yellow-billed, see Coccyzus americanus.
Curlew, Hudsonian, see Numenius hudsonicus.
    Long-billed, see Numenius americanus.
Cyanistes cæruleus—Blue titmouse.
  Admission denied, Ybk. 1905, p. 545.
  Economic status in view of proposed introduction, Rept. 1899, p. 67.
  Feeding on scale insects, Ybk. 1906, pp. 191, 192.
Cyanocephalus cyanocephalus—Piñon jay.
  Feeding on piñon nuts, Fauna 3, pp. 39, 94; (*Pinus monophylla*) Fauna 7, pp. 73, 337.
Cyanocitta cristata—Blue jay.
  Brief account, Bul. 38, p. 55; F. Bul. 54, pp. 14–15 (292 stomachs); F. Bul. 54 (rev.), pp. 18–19 (300 stomachs); Ybk. 1907, pp. 171–172.
  Feeding on boll weevil, Circ. 64, p. 5; brown-tail moth, Ybk. 1907, pp. 171–172; eggs and young of smaller birds, Rept. 1888, p. 514; English sparrow, Bul. 1, pp. 31, 32, 233, 234; mahaleb cherry, Bul. 32, p. 65; scale insects, Ybk. 1906, p. 197.
  Food at Marshall Hall, Bul. 17, pp. 20, 24, 29, 32, 35, 38, 40, 60, 93–94 (6 stomachs).
  Formal report, Ybk. 1896, pp. 197–206 (292 stomachs).
  Predatory, Bul. 1, p. 268; Bul. 34, p. 47.
  Reference to studies of food habits, Ybk. 1899, p. 265.
Cyanocitta stelleri—Steller's jay.
  Brief account, F. Bul. 54 (rev.), pp. 19–20.
  Feeding on piñon nuts, Fauna 3, pp. 39, 94.
  Food in California, Bul 34, pp. 8, 47–49 (93 stomachs).
Cyanospiza ciris, see Passerina ciris.
Cyanospiza cyanea, see Passerina cyanea.
Cyclorrhynchus psittaculus, see Phaleris psittacula.
Cyrtonyx montezumæ mearnsi—Mearns's quail.
  Formal report, Bul. 21, pp. 63–64 (9 stomachs).

D.

Dafila acuta—Pintail.
  Brief account, Bul. 38, p. 20.
  Feeding on *Lymnæa palustris*, Fauna 27, p. 283.
  Vegetable food, Circ. 81, p. 1.
Dendragapus obscurus—Dusky grouse.
  Feeding on ants, Fauna 16, p. 110; bearberries (*Arctostaphylos uva-ursi*), Fauna 5, p. 93; Fauna 27, p. 337; currants (*Ribes cereum*), grasshoppers and other insects, leaves of willow, Fauna 5, p. 93; (*Salix myrtillifolia*) Fauna 27, p. 337; manzanita berries (*Arctostaphylos nevadensis*), Fauna 16, p. 110; mountain cranberries (*Vitis-idæa vitis-idæa*), Fauna 27, p. 337; seeds of *Pentstemon gracilentus*, Fauna 16, p. 110.
  Formal report, Bul. 24, pp. 41–44 (45 stomachs).
Dendroica æstiva—Yellow warbler.
  Brief account, Bul. 38, p. 77.
  Feeding on boll weevil, Bul. 29, pp. 6, 21, 25, 30; Circ. 64, p. 5; mulberries, Rept. 1890, p. 285; scale insects, Ybk. 1906, p. 194.
  Food at Marshall Hall, Bul. 17, pp. 20, 23, 24, 25, 30, 33, 34, 35, 39, 40, 103–104 (7 stomachs).
  Food in California, Bul. 30, pp. 47–49 (98 stomachs).
Dendroica auduboni—Audubon's warbler.
  Feeding on insects (in cabbage), Fauna 7, p. 119; (noxious) Ybk. 1904, p. 254; scale insects, Ybk. 1906, pp. 194, 195.
  Food in California, Bul. 30, pp. 43–46 (383 stomachs).
Dendroica cærulescens—Black-throated blue warbler.
  Food at Marshall Hall, Bul. 17, p. 20.
Dendroica castanea—Bay-breasted warbler.
  Feeding on mulberries, Rept. 1890, p. 285.
Dendroica coronata—Myrtle warbler.
  Brief account, Bul. 38, p. 78.
  Distributing poison Rhus seeds, Rept. 1890, p. 283.
  Feeding on boll weevil, Circ. 64, p. 5; scale insects, Ybk. 1906, pp. 194, 195; seeds, Rept. 1890, p. 282.
  Food at Marshall Hall, Bul. 17, pp. 20, 62, 103–104.
  Food in California, Bul. 30, p. 46 (10 stomachs).
Dendroica discolor—Prairie warbler.
  Food at Marshall Hall, Bul. 17, pp. 20, 34, 103–104.
Dendroica maculosa, see Dendroica magnolia.
Dendroica magnolia—Magnolia warbler.
  Feeding on scale insects, Ybk. 1906, p. 195.

- Dendroica magnolia—Continued.
  - Food at Marshall Hall, Bul. 17, pp. 20, 29, 34, 35, 40, 103–104.
- Dendroica palmarum—Palm warbler.
  - Number of insects eaten per minute, Bul. 17, p. 104.
- Dendroica striata—Black-poll warbler.
  - Feeding on scale insects, Ybk. 1906, p. 195.
  - Food at Marshall Hall, Bul. 17, pp. 20, 23, 24, 29, 34, 35, 39, 40, 103–104 (11 stomachs).
- Dendroica tigrina—Cape May warbler.
  - Feeding on mulberries, Rept. 1890, p. 285.
- Dendroica townsendi—Townsend's warbler.
  - Feeding on scale insects, Ybk. 1906, p. 197.
  - Food in California, Bul. 30, pp. 46–47 (31 stomachs).
- Dendroica vigorsi—Pine warbler.
  - Brief account, Bul. 38, p. 80.
  - Food at Marshall Hall, Bul 17, p. 20.
- Dendroica virens—Black-throated green warbler.
  - Food at Marshall Hall, Bul. 17, p. 20.
- Dickcissel, see Spiza americana.
- Dolichonyx oryzivorus—Bobolink.
  - Bounty laws, Ybk. 1896, p. 57; Ybk. 1899, p. 279.
  - Brief account, Bul. 38, pp. 56–57; F. Bul. 54, pp. 4, **17–19**; F. Bul. 54 (rev.), pp. 4, **23–24**; Rept. 1886, pp. 246–250; Ybk. 1907, p. 171.
  - Damage to grain, Bul. 1, p. 70; Bul. 12, pp. 35, 36; Bul. 12 (rev.), p. 42; Bul. 32, p. 80; Rept. 1887, pp. 428, 431; Ybk. 1898, pp. 230, 232; rice, Bul. 1, p. 76; Bul. 3, p. 9; Bul. 12, p. 18; Bul. 12 (rev.), pp. 25–26; Bul. 15, p. 17; Bul. 30, p. 12; Ent. Circ. 20 [p. 2]; Circ. 1 [p. 2]; Circ. 5 [p. 1]; Rept. 1886, pp. 229, 234, 235, 246–250; Rept. 1900, p. 44; Ybk. 1903, p. 375; Ybk. 1904, pp. 245, 253.
  - Feeding on weed seeds, Ybk. 1898, pp. 230, 232; wild rice, Bul. 1, p. 76; Bul. 3, p. 9; Bul. 12, p. 18.
  - Food at Marshall Hall, Bul. 17, pp. 24, 30, 34, 35, 40, 71, 95 (6 stomachs).
  - Formal report, Bul. 13, pp. 8, 9, 11, **12–22** (291 stomachs).
  - Injurious, hence exempt from protection in certain States, Bul. 12, p. 36; Bul. 12 (rev.), p. 43.
  - Insectivorous, Bul. 12, pp. 14, 24; Bul. 12 (rev.), pp. 22, 31.
  - Other notes, Rept. 1887, pp. 400–401; Rept. 1890, p. 279; Ybk. 1904, pp. 245, 253.
  - Request for information on economic relations, Ent. Circ. 20 [p. 2]; Circ. 1 [p. 2]; Cir. 5 [p. 1]; Rept. 1886, pp. 230, 234.
- Dove, Ground, see Chæmepelia passerina terrestris.
  - Mourning, see Zenaidura macroura carolinensis.
  - Ring, see Columba palumbus.
  - Rock, see Columba livia.
- Dowitcher, see Macrorhamphus griseus.
- Dryobates arizonæ—Arizona woodpecker.
  - Relation to orchards, Ybk. 1900, p. 295.
- Dryobates borealis—Red-cockaded woodpecker.
  - Feeding on scale insects, Ybk. 1906, p. 197.
  - Formal report, Bul. 37, pp. 10, 22–23 (76 stomachs).
  - Relation to orchards, Ybk. 1900, p. 295.
- Dryobates nuttalli—Nuttall's woodpecker.
  - Feeding on scale insects, Ybk. 1906, p. 194.
  - Food in California, Bul. 34, pp. 19–21 (46 stomachs).
  - Formal report, Bul. 37, pp. 10, 23–25 (53 stomachs).
  - Relation to orchards, Ybk. 1900, p. 295.
- Dryobates pubescens—Downy woodpecker.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, Bul. 34, p. 17; Bul. 38, p. 46; F. Bul. 54, pp. **6–7**, **9**; F. Bul. 54 (rev.), pp. **9–10**, **13**; Ybk. 1900, pp. 292–293, 295, 427.
  - Damage to posts, Bul. 39, p. 13.
  - Distributing poison Rhus seeds, Rept. 1890, p. 283.
  - Feeding on mulberries, Rept. 1890, p. 285; scale insects, Ybk. 1906, pp. 194, 197.
  - Food at Marshall Hall, Bul. 17, pp. 19, 24, 33, 34, 35, 38, 40, 47, 59, 60, 61, 62, 76, 88 (13 stomachs).
  - Food in California, Bul. 34, pp. **17–19**, 20 (80 stomachs).
  - Food of nestlings, Ybk. 1900, p. 427.
  - Formal report, Bul. 7, pp. 8, 9, 10, **11–14**, 15, 16, 18, 38 (140 stomachs); Bul. 37, pp. 10, 11, 12, **17–22**, 24 (723 stomachs).
  - Relation to orchards, Ybk. 1900, pp. 292–293, 295.
  - Tapping trees, Bul. 39, pp. 92–95.
- Dryobates scalaris bairdi—Texas woodpecker.
  - Brief account, Bul. 37, p. 63.
  - Damage to poles, Bul. 39, pp. 10, 11; posts, Bul. 39, p. 13.
  - Relation to orchards, Ybk. 1900, p. 295.
- Dryobates scalaris graysoni — Grayson's woodpecker.
  - Feeding habits, Fauna 14, p. 43.
- Dryobates scalaris lucasanus—San Lucas woodpecker.
  - Damage to poles, Bul. 39, p. 11.
  - Relation to orchards, Ybk. 1900, p. 295.
- Dryobates villosus—Hairy woodpecker.
  - Beneficial, Bul. 38, p. 46; Ybk. 1897, p. 670.

Dryobates villosus—Continued.
Brief account, Bul. 34, p. 16; F. Bul. 54, pp. 6–7, 9; F. Bul. 54 (rev.), pp. 9–10, 13; Ybk. 1900, pp. 292, 293–294.
Damage to posts, Bul. 39, p. 13.
Distributing poison Rhus seeds, Rept. 1890, p. 283.
Feeding on scale insects, Ybk. 1906, p. 197.
Food in California, Bul. 34, pp. 15–17, 20, 22 (27 stomachs).
Formal report, Bul. 7, pp. 8, 9, 10, 11, 14–16, 18, 38 (82 stomachs); Bul. 37, pp. 10, 11, 12, 13–17 (382 stomachs).
Relation to orchards, Ybk. 1900, pp. 292, 293–294.
Tapping trees, Bul. 39, pp. 92–95.
Duck, Black, see Anas rubripes.
Greater scaup, see Marila marila.
Lesser scaup, see Marila affinis.
Mallard, see Anas platyrhynchos.
Pintail, see Dafila acuta.
Ring-necked, see Marila collaris.
Ruddy, see Erismatura jamaicensis.
Spoonbill, see Spatula clypeata.
Wood, see Aix sponsa.
Dumetella carolinensis—Catbird.
Beneficial, Bul. 38, p. 9.
Brief account, Bul. 38, p. 85; F. Bul. 54, pp. 33–34; F. Bul. 54 (rev.), pp. 39–40 (213 stomachs); Ybk. 1900, pp. 303–304, 416.
Feeding on fruit, Rept. 1890, p. 281; Ybk. 1907, p. 169; mahaleb cherries (*Prunus mahaleb*), Bul. 32, p. 65; mulberries, Bul. 32, pp. 64, 65; Rept. 1890, p. 285.
Food at Marshall Hall, Bul. 17, pp. 17–18, 21, 23, 24, 25, 26, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 43, 47, 55–56, 57, 58, 59, 60, 61, 62, 104–105 (74 stomachs).
Food of nestlings, Ybk. 1900, pp. 416, 436.
Formal report, Ybk. 1895, pp. 405, 406–411, 414, 418 (213 stomachs).
Other notes, Bul. 1, pp. 126, 304; Bul. 15, p. 29.
Reference to studies of food habits, Ybk. 1899, p. 266.
Relation to orchards, Ybk. 1900, pp. 303–304.
Request for information on economic relations, Ent. Circ. 20 [p. 2].

E.

Eagle, Bald, see Haliæetus leucocephalus.
Golden, see Aquila chrysaëtos.
Gray sea, see Haliæetus albicilla.
Ectopistes migratorius—Passenger pigeon.
Damage to grain, Fauna 27, p. 351.
Food of adults and nestlings, Ybk. 1900, p. 431.
Egret, see Herodias egretta.
Snowy, see Egretta candidissima.
Egretta candidissima—Snowy egret.
Brief account, Ybk. 1900, p. 435.
Feeding on field mice, Bul. 31, p. 52.
Elainoides forficatus—Swallow-tailed kite.
Beneficial, Bul. 31, p. 45; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
Brief account, Bul. 38, p. 37; Circ. 61, pp. 3, 4; Ybk. 1894, pp. 217, 218.
Formal report, Bul. 3, pp. 11, 20–22, 23, 24 (6 stomachs); Rept. 1887, p. 403 (5 stomachs).
Elanus leucurus—White-tailed kite.
Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
Brief account, Bul. 3, pp. 11, 23; Circ. 61, pp. 3, 4; Ybk. 1894, pp. 217, 218.
Feeding on lizards and snakes, Bul. 2, p. 113.
Emberiza citrinella—Old-world yellow-hammer.
Injurious in New Zealand, Ybk. 1909, p. 257.
Empidonax difficilis—Western yellow-bellied flycatcher.
Food in California, Bul. 34, pp. 41–44 (141 stomachs).
Empidonax minimus—Least flycatcher.
Feeding on boll weevil, Bul. 25, pp. 8, 13, 17, 19, 20, 21; Bul. 29, pp. 6, 14–15, 24, 30; Circ. 64, p. 5; mulberries, Bul. 32, p. 64; Rept. 1890, p. 285.
Empidonax trailli—Traill's flycatcher.
Brief account, Bul. 34, p. 44.
Feeding on boll weevil, Bul. 29, pp. 6, 15, 24, 30; Circ. 64, p. 5.
Empidonax virescens—Acadian flycatcher.
Brief account, Bul. 38, p. 54.
Feeding on rose beetle, Bul. 32, p. 20.
Food at Marshall Hall, Bul. 17, pp. 36, 92.
Ereunetes pusillus—Peep.
Feeding on mosquitoes, Circ. 79, p. 2.
Erismatura jamaicensis—Ruddy duck.
Vegetable food, Circ. 81, p. 1.
Euphagus carolinus—Rusty blackbird.
Brief account, Bul. 38, p. 59; Ybk. 1897, pp. 351–352.
Damage to grain, Rept. 1887, p. 428; Ybk. 1897, pp. 351–352; Ybk. 1898, p. 230.
Feeding on boll weevil, Circ. 64, pp. 3, 5; weed seeds, Ybk. 1898, p. 230.
Food at Marshall Hall, Bul. 17, pp. 14, 35, 38, 39, 71, 77, 96.
Formal report, Bul. 13, pp. 9, 45–49 (132 stomachs).
Euphagus cyanocephalus—Brewer's blackbird.
Brief account, Ybk. 1897, pp. 351–352.
Damage to fruit, Bul. 30, p. 13; Ybk. 1904, pp. 246, 248; grain, Bul. 23,

Euphagus cyanocephalus—Continued.
- p. 15; Bul. 29, p. 8; Fauna 27, p. 412; Rept. 1887, p. 430; Ybk. 1897, pp. 351–352; Ybk. 1898, p. 230.
- Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 9, 10, 11–12, 21; Bul. 29, pp. 6, 7, 8, 11, 17, 27, 28, 30; Circ. 64, pp. 3, 5; cankerworms, Ybk. 1908, p. 345; corn, Bul. 29, p. 8; crumbs in streets and dooryards, Fauna 5, p. 101; grasshoppers, Fauna 7, p. 78; weed seeds, Ybk. 1898, p. 230; wheat, Bul. 23, p. 15.
- Food in California, Bul. 34, pp. 59–65 (312 stomachs).
- Formal report, Bul. 13, pp. 9, 10, 11, 50–52 (146 stomachs).
- Relation to fruit in California, Bul. 30, p. 13; Ybk. 1904, pp. 246, 248.

Euxenura maguari—Maguari stork.
- Feeding on mice, Bul. 31, pp. 52–53.

F.

Falco columbarius—Pigeon hawk.
- Brief account, Bul. 31, p. 45; Bul. 38, p. 40; Circ. 61, pp. 3, 13, **14**; Ybk. 1894, pp. 217, 227, 228.
- Equally beneficial and injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
- Feeding on crossbills, Fauna 21, p. 76; English sparrow, Bul. 1, pp. 32, 309; field mice, Bul. 31, p. 45; Fauna 19, p. 75; Ybk. 1905, p. 371; red-backed mouse, Fauna 19, p. 75; ruby-crowned kinglet, Fauna 30, p. 38; sparrow, Fauna 27, p. 363; tree sparrow, Fauna 27, p. 364.
- Formal report, Bul. 3, pp. 15, **109–113**, **114**, 115 (60 stomachs); Rept. 1887, pp. 402, 414 (19 stomachs).
- Injurious, Bul. 12, p. 30; Bul. 12 (rev.), p. 33.

Falco fusco-cærulescens—Aplomado falcon.
- Brief account, Bul. 3, pp. 15, **114–115**; Circ. 61, pp. 3, 13, 14; Ybk. 1894, pp. 217, 227, 228.
- Equally beneficial and injurious. Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Falco islandus—White gyrfalcon.
- Brief account, Bul. 3, pp. 15, 16, 102; Circ. 61, pp. 3, 16; Ybk. 1894, pp 218, 230.
- Injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Falco mexicanus—Prairie falcon.
- Brief account, Bul. 31, p. 45; Circ. 61, pp. 3, 13, **14–15**; Rept. 1887, p. 414; Ybk. 1894, pp. 217, 227, **228–229**.
- Equally beneficial and injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
- Feeding on chicken (chasing), Fauna 5, p. 95; doves (chasing), Fauna 7, p. 40; ducks, Gambel's quail (watching), Fauna 7, p. 39; horned larks, Bul. 23, p. 12; Fauna 5, p. 95; jack rabbits, Bul. 8, p. 44; spermophiles, Bul. 4, pp. 16–17.
- Formal report, Bul. 3, pp. 15, **104–106** (11 stomachs).

Falco peregrinus—Duck hawk.
- Brief account, Bul. 31, p. 44; Bul. 38, pp. 10, 40; Circ. 61, pp. 3, **16–17**; Ybk. 1894, pp. 218, **230–231**.
- Feeding on Alaska jays, intermediate sparrows, Fauna 19, p. 75; mallard (chasing), Fauna 27, p. 362; marsh hawks, Fauna 19, p. 75; scaup duck (chasing), Fauna 30, p. 88; sparrow hawk (chasing), Fauna 14, p. 38; varied thrushes, Fauna 19, p. 75; white-winged crossbills, Fauna 19, pp. 75, 82.
- Formal report, Bul. 3, pp. 15, 16, **106–109**, 184 (20 stomachs); Rept. 1887, pp. 402, **414** (5 stomachs).
- Injurious, Bul. 12, p. 30; Bul. 12 (rev.), p. 33; Bul. 38, p. 10; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670; Ybk. 1908, p. 192.

Falco richardsoni, see Falco columbarius.

Falco rusticolus—Gray gyrfalcon.
- Brief account, Bul. 3, pp. 15, 16, **102–108**; Circ. 61, pp. 3, 16; Ybk. 1894, pp. 218, 230.
- Feeding on bird, Fauna 19, p. 74; ptarmigan (apparently chasing), Fauna 27, p. 361.
- Injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.

Falco sparverius—Sparrow hawk.
- Beneficial, Bul. 12, p. 30; Bul. 12 (rev.), p. 33; Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
- Brief account, Bul. 12, p. 30; Bul. 12 (rev.), p. 33; Bul. 31, p. 45; Bul. 38, p. 41; Circ. 61, pp. 3, **9–10**; Ybk. 1894, pp. 217, **223**; Ybk. 1900, p. 430.
- Feeding on cotton rat (*Sigmodon hispidus texianus*), Fauna 25, p. 116; English sparrow, Bul. 1, pp. 32, 150, 234, 309; Rept. 1886, p. 245; field mice, Bul. 31, p. 45; Ybk. 1905, p. 371; (*Microtus drummondi*) Fauna 27, p. 365; grasshoppers, Bul. 12, p. 30; Bul. 12 (rev.), p. 33; Fauna 3, p. 39; Fauna 5, p. 95; Fauna 7, p. 41; Fauna 16, p. 113; Ybk. 1907, p. 166; insects, Fauna 3, p. 91; red-backed mouse (*Evotomys dawsoni*), Fauna 27, p. 365; snake, Fauna 7, p. 41.
- Food at Marshall Hall, Bul. 17, pp. 19, 86.
- Food of nestlings, Ybk. 1900, p. 430.

- Falco sparverius—Continued.
  - Formal report, Bul. 3, pp. 11, 13, **115–127, 192** (320 stomachs); Rept. 1887, pp. 414–417 (133 stomachs); Rept. 1888, pp. 491–496 (163 stomachs).
  - Other notes, Bul. 1, p. 150; Bul. 9, p. 16; Bul. 30, pp. 33–34; Rept. 1886, p. 245.
- Falcon, Aplomado, see Falco fusco-cærulescens.
  - Prairie, see Falco mexicanus.
- Finch, Gray-crowned rosy, see Leucosticte tephrocotis.
  - House, see Carpodacus mexicanus frontalis.
  - Purple, see Carpodacus purpureus.
- Flicker, see Colaptes auratus.
  - Gilded, see Colaptes chrysoides.
  - Red-shafted, see Colaptes cafer collaris.
- Florida cærulea—Little blue heron.
  - Brief account, Bul. 38, p. 26; Ybk. 1900, p. 435.
  - Food at Marshall Hall, Bul. 17, pp. 19, 81.
- Flycatcher, Acadian, see Empidonax virescens.
  - Ash-throated, see Myiarchus cinerascens.
  - Crested, see Myiarchus crinitus.
  - Least, see Empidonax minimus.
  - Olive-sided, see Nuttallornis borealis.
  - Scissor-tailed, see Muscivora forficata.
  - Traill's, see Empidonax traillii.
  - Western yellow-bellied, see Empidonax difficilis.
- Foudia madagascariensis — Madagascar weaver bird.
  - Injurious wherever introduced, Rept. 1904, p. 296.
- Fratercula corniculata—Horned puffin.
  - Food of nestlings, Ybk. 1900, p. 433.
- Fringilla cœlebs—Chaffinch.
  - Feeding on caterpillars, corn, Bul. 1, p. 343; seeds, Bul. 1, p. 335.
  - Injurious in New Zealand, Ybk. 1909, p. 257.
- Fulica americana—Coot.
  - Brief account, Bul. 38, pp. 18, 28–29.
  - Food at Marshall Hall, Bul. 17, pp. 81–82.

G.

- Gadwell, see Chaulelasmus streperus.
- Galeoscoptes carolinensis, see Dumetella carolinensis.
- Gallinago delicata—Jacksnipe.
  - Feeding on click beetles, crane flies, crayfish, Circ. 79, p. 6; Dytiscidæ, Circ. 79, p. 8; grasshoppers, Circ. 79, p. 4; wireworms, Circ. 79, p. 6.
- Garrulus glandarius—Old-world jay.
  - Food of nestlings, Ybk. 1900, p. 411.
- Gavia arctica—Black-throated loon.
  - Food of nestlings, Ybk. 1900, p. 433.
- Gavia stellata—Red-throated loon.
  - Feeding on fishes, Fauna 27, p. 259.
- Geococcyx californianus—Road runner.
  - Feeding on field mice, Bul. 31, p. 51.
- Geothlypis trichas—Yellowthroat.
  - Brief account, Bul. 38, p. 82.
  - Feeding on boll weevil, Circ. 64, p. 5; scale insects, Ybk. 1906, p. 194.
  - Food at Marshall Hall, Bul. 17, pp. 20, 22, 24, 28, 30, 32, 34, 35, 38, 39, 40, 103–104 (13 stomachs).
  - Food in California, Bul. 30, pp. 49–50 (114 stomachs).
  - Insectivorous, Ybk. 1908, p. 344.
- Glaucidium gnoma—Pygmy owl.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Feeding on spermophiles, Bul. 4, p. 16.
  - Food of nestlings, Ybk. 1900, p. 431.
  - Formal report, Bul. 3, pp. 11, **196–198** (6 stomachs).
- Glaucidium phalœnoides—Ferruginous pygmy owl.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 3, pp. 11, **199**.
- Glaux funerea richardsoni, see Cryptoglaux funerea richardsoni.
- Gnatcatcher, Black-tailed, see Polioptila californica.
  - Blue-gray, see Polioptila cærulea.
- Godwit, Hudsonian, see Limosa hæmastica.
  - Marbled, see Limosa fedoa.
- Golden-eye, see Clangula clangula americana.
- Goldfinch, see Astragalinus tristis.
  - Green-backed, see Astragalinus psaltria hesperophilus.
- Goose, Canada, see Branta canadensis.
  - Snow, see Chen hyperboreus.
- Goshawk, see Astur atricapillus.
  - Mexican, see Asturina plagiata.
- Grackle, Purple, see Quiscalus quiscula.
- Grebe, Horned, see Colymbus auritus.
  - Pied-billed, see Podilymbus podiceps.
- Greenfinch, see Chloris chloris.
- Grosbeak, Alaska pine, see Pinicola enucleator alascensis.
  - Black-headed, see Zamelodia melanocephala.
  - Blue, see Guiraca cærulea.
  - Evening, see Hesperiphona vespertina.
  - Gray, see Pyrrhuloxia sinuata.
  - Pine, see Pinicola enucleator leucura.
  - Rose-breasted, see Zamelodia ludoviciana.

Grouse, Dusky, see Dendragapus obscurus.
Franklin's, see Canachites franklini.
Ruffed, see Bonasa umbellus.
Sharp-tailed, see Pediœcetes phasianellus.
Spruce, see Canachites canadensis.
Wood, see Tetrao urogallus.

Grus americana—Whooping crane.
Feeding on field mice, Bul. 31, p. 53.

Grus canadensis—Little brown crane.
Feeding on barley, Fauna 7, pp. 20–21; field mice, Bul. 31, p. 53; foliage and rootlets, Fauna 7, pp. 20–21.

Grus mexicana—Sandhill crane.
Feeding on field mice, Bul. 31, p. 53.
Food of young in captivity, Ybk. 1900, p. 433.

Guiraca caerulea—Blue grosbeak.
Brief account, F. Bul. 456, pp. 11–12.
Feeding on weed seeds, Ybk. 1898, p. 230.
Formal report, Bul. 32, pp. 78–85, 87, 91 (51 stomachs).

Guiraca ludoviciana, see Zamelodia ludoviciana.

Gull, California, see Larus californicus.
Franklin's, see Larus franklini.
Glaucous-winged, see Larus glaucescens.
Great black-backed, see Larus marinus.
Heermann's, see Larus heermanni.
Herring, see Larus argentatus.
Laughing, see Larus atricilla.
Ring-billed, see Larus delawarensis.
Short-billed, see Larus brachyrhynchus.

Gymnogyps californianus—California condor.
Feeding on carrion, Fauna 7, p. 33.

Gyrfalcon, Gray, see Falco rusticolus.
White, see Falco islandus.

H.

Habia ludoviciana, see Zamelodia ludoviciana.

Haliæetus albicilla—Gray sea eagle.
Compiled information, Bul. 27, pp. 18–20.

Haliæetus leucocephalus—Bald eagle.
Brief account, Bul. 38, p. 40; Circ. 61, pp. 3, 13, 14; Ybk. 1894, pp. 217, 227–228; Ybk. 1900, p. 430.
Compiled information, Bul. 27, pp. 6–17.
Equally beneficial and injurious, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
Feeding on crustaceans and mollusks, Fauna 21, p. 43; rabbits, Ybk. 1907, p. 336; spermophiles, Bul. 4, p. 16.
Food at Marshall Hall, Bul. 17, pp. 19, 50, 53.

Haliæetus leucocephalus—Continued.
Formal report, Bul. 3, pp. 15, 97–101 (21 stomachs); Rept. 1887, p. 413 (6 stomachs).
Protected in some States, Ybk. 1899, p. 266.

Harporhynchus lecontei, see Toxostoma lecontei.

Harporhynchus rufus, see Toxostoma rufum.

Hawk, Broad-winged, see Buteo platypterus.
Buzzard, see Buteo buteo.
Cooper's, see Accipiter cooperi.
Duck, see Falco peregrinus.
Ferruginous rough-legged, see Archibuteo ferrugineus.
Harris's, see Parabuteo unicinctus harrisi.
Marsh, see Circus hudsonius.
Mexican black, see Urubutinga anthracina.
Pigeon, see Falco columbarius.
Red-shouldered, see Buteo lineatus.
Red-tailed, see Buteo borealis.
Richardson's, see Falco columbarius.
Rough-legged, see Archibuteo lagopus sancti-johannis.
Rough-legged buzzard, see Archibuteo lagopus lagopus.
Sennett's white-tailed, see Buteo albicaudatus sennetti.
Sharp-shinned, see Accipiter velox.
Short-tailed, see Buteo brachyurus.
Sparrow, see Falco sparverius.
Squirrel, see Archibuteo ferrugineus.
Swainson's, see Buteo swainsoni.
Zone-tailed, see Buteo abbreviatus.

Heath hen, see Tympanuchus cupido.

Heleodytes brunneicapillus couesi—Cactus wren.
Feeding on scale insects, Ybk. 1906, p. 194.
Food in California, Bul. 30, pp. 64–65 (41 stomachs).

Helminthophila celata lutescens, see Vermivora celata lutescens.

Helmitheros vermivorus—Worm-eating warbler.
Brief account, Bul. 38, p. 75.
Feeding on scale insects, Ybk. 1906, p. 195.
Food at Marshall Hall, Bul. 17, pp. 34, 103–104.

Helodromas solitarius—Solitary sandpiper.
Feeding on grasshoppers, Circ. 79, p. 4.
Food at Marshall Hall, Bul. 17, p. 19.

Herodias egretta—Egret.
Feeding on field mice, Bul. 31, p. 52.

Heron, Black-crowned night, see Nycticorax nycticorax nævius.
Great blue, see Ardea herodias.
Green, see Butorides virescens.
Little blue, see Florida caerulea.

- Hesperiphona vespertina—Evening grosbeak.
  - Brief account, Bul. 32, p. 5.
  - Feeding on cedar berries (*Juniperus occidentalis*), Fauna 16, pp. 123, 139; weed seeds, Ybk. 1898, p. 230.
- Himantopus knudseni—Kukuluaeo.
  - Feeds on caterpillars and cutworms, protected in Hawaii, Bul. 12 (rev.), p. 87.
- Himantopus mexicanus—Black-necked stilt.
  - Feeding on bill bugs, crayfishes, Circ. 79, p. 6; Dytiscidæ, Circ. 79, p. 8; grasshoppers, Circ. 79, p. 4.
- Hirundo erythrogastra—Barn swallow.
  - Brief account, Bul. 38, p. 71; F. Bul. 54, p. 31; F. Bul. 54 (rev.), pp. 36–38; Ybk. 1900, p. 418.
  - Destroying nests and brood of English sparrows, Bul. 1, p. 282.
  - Feeding on bayberries, Rept. 1890, p. 282; boll weevil, Bul. 29, pp. 6, 13–14, 25, 30; Bul. 38, p. 71; Circ. 56, pp. 1–2; Circ. 57, p. 2; Circ. 64, p. 5.
  - Food at Marshall Hall, Bul. 17, pp. 20, 24, 25, 26, 34, 35, 36, 40, 46, 98–99 (10 stomachs).
  - Food in California, Bul. 30, pp. 30–32 (82 stomachs).
  - Food of nestlings, Ybk. 1900, p. 418.
  - Protection urged, as enemy of boll weevil, Circ. 56, pp. 1–2; Circ. 57, p. 2.
  - Relation to bedbugs, Circ. 57, p. 2.
- Hirundo rustica—Old-world Swallow.
  - Value as insect destroyer, Rept. 1886, p. 244.
- Hirundo urbica, see Chelidonaria urbica.
- Humming bird, Grayson's, see Amizilis graysoni.
  - Ruby-throated, see Archilochus colubris.
- Hydrochelidon nigra surinamensis—Black tern.
  - Feeding on imago of cotton-boll worm, Ybk. 1908, p. 194.
- Hylocichla aliciæ—Gray-checked thrush.
  - Brief account, Bul. 38, p. 91.
  - Food at Marshall Hall, Bul. 17, pp. 20, 24, 29, 32, 34, 35, 38, **108**.
- Hylocichla fuscescens—Veery.
  - Brief account, Bul. 38, p. 90.
  - Food at Marshall Hall, Bul. 17, p. 20.
- Hylocichla guttata—Hermit thrush.
  - Beneficial, Ybk. 1907, p. 169.
  - Brief account, Bul. 38, p. 91.
  - Feeding on berries of *Celastrus scandens*, Bul. 1, p. 273; potato beetle, Bul. 32, p. 47.
  - Food at Marshall Hall, Bul. 17, p. 20.
  - Food in California, Bul. 30, pp. 92–93 (68 stomachs).
- Hylocichla mustelina—Wood thrush.
  - Beneficial, Ybk. 1907, p. 169.
  - Brief account, Bul. 38, p. 90.
- Hylocichla mustelina—Continued.
  - Feeding on mulberries, Rept. 1890, p. 285; potato beetle, Bul. 32, p. 47.
  - Food at Marshall Hall, Bul. 17, p. 20.
- Hylocichla ustulata—Olive-backed thrush.
  - Feeding on potato beetle, Bul. 32, p. 47; spiders, Fauna 27, p. 493.
  - Food at Marshall Hall, Bul. 17, pp. 20, 29, 34, 38, 40, **108**.
  - Food in California, Bul. 30, pp. 13, **86–92** (157 stomachs).
  - Relation to fruit in California, Ybk. 1904, pp. 246, 251.

I.

- Ibis, Wood, see Mycteria americana.
- Icteria virens—Yellow-breasted chat.
  - Brief account, Bul. 38, p. 82.
  - Feeding on boll weevil, Bul. 29, pp. 6, 21, 25, 30; Circ. 64, p. 5.
  - Food at Marshall Hall, Bul. 17, pp. 18, 24, 29, 34, 35, 37, 38, 40, 103–104.
- Icterus bullocki—Bullock's oriole.
  - Brief account, F. Bul. 54 (rev.), p. 29 (70 stomachs).
  - Feeding on boll weevil, Bul. 25, pp. 9, 10–11, 18, 20, 21; Bul. 29, pp. 6, 16, 25, 30; Circ. 64, p. 5; cherries, Bul. 34, p. 54; codling moth, Rept. 1904, p. 293; cotton worm, Bul. 25, p. 20; scale insects, Ybk. 1906, p. 194.
  - Food in California, Bul. 34, pp. 54, **68–71** (162 stomachs).
  - Relation to fruit in California, Bul. 30, p. 13; Ybk. 1904, pp. 246, 251.
- Icterus galbula—Baltimore oriole.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, Bul. 38, p. 59; F. Bul. 54, pp. 23–24 (113 stomachs); F. Bul. 54 (rev.), p. 28 (202 stomachs); Ybk. 1900, p. 298.
  - Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 9, 10–11, 18, 20, 21; Bul. 29, pp. 6, 16, 24, 25, 30; Bul. 38, p. 59; Circ. 64, p. 5; cherries, Bul. 1, p. 60; cotton worms, Bul. 25, p. 20; grapes, Bul. 1, p. 324; Ybk. 1904, p. 251; mulberries, Rept. 1890, p. 285; peas, Bul. 1, p. 60; scale insects, Ybk. 1906, p. 197; tent caterpillars, tussock moth caterpillars, Bul. 1, pp. 108, 324; Rept. 1886, p. 244.
  - Food at Marshall Hall, Bul. 17, pp. 28, 30, 40, 59, 60, **96**.
  - Food of nestlings, Ybk. 1900, p. 422.
  - Formal report, Ybk. 1895, pp. 419–420, **426–430** (113 stomachs).
  - Other notes, Bul. 34, pp. 68, 69.
  - Reference to studies of food habits, Ybk. 1899, p. 266.
  - Relation to orchards, Ybk. 1900, p. 298.

Icterus graysoni—Grayson's oriole.
- Feeding on fig, Fauna 14, p. 61; fruit of Cereus, insects, spiders, weevils, Fauna 14, p. 51.

Icterus spurius—Orchard oriole.
- Brief account, Bul. 38, p. 59.
- Feeding on boll weevil, Bul. 25, pp. 9, 10–11, 16, 17, 18, 20, 21; Bul. 29, pp. 6, 16, 24, 25, 29, 30; Bul. 38, p. 59; Circ. 64, p. 5; cotton worms, Bul. 25, p. 20; mulberries, Rept. 1890, p. 285; scale insects, Ybk. 1906, p. 197.
- Food at Marshall Hall, Bul. 17, pp. 17, 24, 25, 30, 32, 34, 35, 40, 44–45, 49, 55, 56, 59, 60, 61, 96, 110 (11 stomachs).
- Food of nestlings, Ybk. 1900, p. 422.
- Request for information on economic relations, Ent. Circ. 20 [p. 2].

Ictinia mississippiensis—Mississippi kite.
- Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
- Brief account, Bul. 31, p. 45; Bul. 38, p. 37; Circ. 61, pp. 3, 4; Rept. 1887, p. 403; Ybk. 1894, pp. 217, 218.
- Formal report, Bul. 3, pp. 11, 24–25.

Iridoprocne bicolor—Tree swallow.
- Feeding on bayberries, Bul. 30, p. 27; Rept. 1890, p. 282.
- Food at Marshall Hall, Bul. 17, pp. 20, 24, 34, 35, 39, 40, 98–99 (5 stomachs).
- Insectivorous, Bul. 1, p. 96.
- Other notes, Bul. 30, p. 27; Circ. 56, pp. 1–2; F. Bul. 54, p. 31; F. Bul. 54 (rev.), pp. 36–38.

Ixobrychus exilis—Least bittern.
- Feeding on field mice, Bul. 31, p. 52.
- Food at Marshall Hall, Bul. 17, p. 19.

Ixoreus nævius—Varied thrush.
- Feeding on scale insects, Ybk. 1906, pp. 197, 198.

J.

Jacksnipe, see Gallinago delicata.

Jaeger, Parasitic, see Stercorarius parasiticus.
- Pomarine, see Stercorarius pomarinus.

Jay, Blue, see Cyanocitta cristata.
- California, see Aphelocoma californica.
- Canada, see Perisoreus canadensis.
- Old-world, see Garrulus glandarius.
- Piñon, see Cyanocephalus cyanocephalus.
- Steller's, see Cyanocitta stelleri.
- Woodhouse's, see Aphelocoma woodhousei.

Junco hyemalis—Snowbird.
- Brief account, Bul. 38, p. 65.
- Feeding on weed seeds, Bul. 9, p. 17; Ybk. 1898, pp. 222, 225, 226, 227.

Junco hyemalis—Continued.
- Food at Marshall Hall, Bul. 17, pp. 16–17, 30, 34, 35, 38, 71, 73, 74, 75 (11 stomachs).
- Food in California, Bul. 34, pp. 82–83, 84 (269 stomachs).
- Formal report, Bul. 15, pp. 18, 27, 28, 37, 38, 39, 41, 42, 43, 44, 45, 46, 80–82 (299 stomachs).
- Other notes, F. Bul. 54, p. 28; F. Bul. 54 (rev.), p. 32.

K.

Kea, see Nestor notabilis.

Killdeer, see Oxyechus vociferus.

Kingbird, see Tyrannus tyrannus.
- Arkansas, see Tyrannus verticalis.
- Cassin's, see Tyrannus vociferans.

Kingfisher, Belted, see Ceryle alcyon.

Kinglet, Golden-crowned, see Regulus satrapa.
- Ruby-crowned, see Regulus calendula.

Kite, Everglade, see Rostrhamus sociabilis.
- Mississippi, see Ictinia mississippiensis.
- Swallow-tailed, see Elainoides forficatus.
- White-tailed, see Elanus leucurus.

Kittiwake, Pacific, see Rissa tridactyla pollicaris.

Knot, see Tringa canutus.

Kohlmeise, see Parus major.

Kukuluaeo, see Himantopus knudseni.

L.

Lagopus lagopus—Willow ptarmigan.
- Feeding on aments of dwarf birch, Fauna 24, p. 66; Fauna 27, p. 342; bearberries (*Mairania alpina*), Fauna 27, p. 343; blueberries, Fauna 24, p. 66; (*Vaccinium uliginosum*) Fauna 27, p. 343; buds, Fauna 24, p. 66; of *Populus balsamifera*, buds and twigs of willows (*Salix bebbiana*), Fauna 27, p. 343; crowberries (*Empetrum nigrum*), Fauna 24, p. 66; Fauna 27, p. 343; foliage, Bul. 24, p. 66; of dwarf birch (*Betula nana*), Fauna 27, p. 343; of dwarf willow (*Salix reticulata*), Fauna 27, pp. 342, 343; of grass, Fauna 27, p. 343; of *Populus balsamifera*, Fauna 27, p. 342; of vetch (*Aragallus*), Fauna 27, pp. 342, 343; of wild rosemary (*Andromeda polifolia*), Fauna 27, p. 342; fruit of *Andromeda polifolia*, mountain cranberries (*Vitisidæa*), mushrooms, Fauna 27, p. 343; seeds of grass, Fauna 27, pp. 343, 344; of *Hedysarum americanum*, Fauna 27, p. 343.
- Formal report, Bul. 24, pp. 44–46 (5 stomachs).

Lagopus leucurus—White-tailed ptarmigan.
- Brief account, Bul. 24, pp. 47–48.

Lagopus rupestris—Rock ptarmigan.
- Brief account, Bul. 24, pp. 46–47.
- Feeding on aments of *Alnus viridis,* Fauna 24, p. 67; blueberries, Fauna 30, p. 37; buds of willow, Fauna 24, p. 67; Fauna 30, p. 87; buds and twigs of *Vaccinium,* Bul. 24, p. 67; crowberries, Fauna 30, p. 37; foliage of *Dryas,* Fauna 24, p. 67; Fauna 30, p. 37; of *Ledum,* Fauna 24, p. 67; fruit of *Cassiope,* Fauna 30, p. 37.

Lanius borealis—Big butcher bird.
- Brief account, Ybk. 1900, pp. 301–302.
- Feeding on bird (chasing), Fauna 5, p. 105; English sparrow, Bul. 1, pp. 31, 150, 233, 234, 238; Rept. 1886, p. 245; field mice, Bul. 31, pp. 51–52; meat and camp refuse, Fauna 30, p. 63; robin (chasing), Fauna 27, p. 459; spotted sandpiper (chasing), Fauna 30, pp. 36, 42.
- Formal report, Bul. 9, pp. 15, 16, 17–20, 24–25, 26 (67 stomachs).
- Other notes, Bul. 1, pp. 150, 234; Rept. 1886, p. 245.
- Reference to studies of food habits, Ybk. 1899, p. 266.
- Relation to orchards, Ybk. 1900, pp. 301–302.

Lanius excubitor—European great butcher bird.
- Brief account, Bul. 9, pp. 15, 19.

Lanius ludovicianus—Little butcher bird.
- Brief account, Bul. 38, p. 73; Ybk. 1900, pp. 302, 416–417.
- Feeding on beetles, Bell's vireo (*Vireo belli*), blue-gray gnatcatcher (*Polioptila caerulea*), Bul. 2, p. 233; boll weevil, Bul. 22, p. 16; Bul. 25, pp. 9, 14–15, 21; Bul. 29, pp. 6, 22, 30; Circ. 64, p. 5; carrion, Bul. 2, p. 233; field mice, Bul. 31, p. 52; Ybk. 1905, p. 371; (*Microtus montanus*) F. Bul. 335, p. 12; F. Bul. 352, p. 21; grasshoppers, Bul. 2, p. 233; grasshopper mice (*Perognathus*), insects, lizards, Fauna 7, p. 114; western chipping sparrow (*Spizella passerina zonae*), Bul. 2, p. 233.
- Food at Marshall Hall, Bul. 17, pp. 54, 100–102.
- Food in California, Bul. 30, pp. 33–38 (124 stomachs).
- Food of nestlings, Ybk. 1900, pp. 416–417.
- Formal report, Bul. 9, pp. 15, 16, 17, 20–24, 25–26 (88 stomachs).
- Other notes, Bul. 30, p. 35.
- Reference to studies of food habits, Ybk. 1899, p. 266.
- Relation to orchards, Ybk. 1900, p. 302.

Lanivireo flavifrons—Yellow-throated vireo.
- Brief account, Bul. 38, p. 74.

Lanivireo solitarius cassini—Cassin's vireo.
- Feeding on scale insects, Ybk. 1906, p. 194.
- Food in California, Bul. 30, pp. 40–41 (46 stomachs).

Lark, Horned, see Otocoris alpestris.
- Meadow, see Sturnella magna.
- Shore, see Otocoris alpestris.
- Western meadow, see Sturnella neglecta.

Larus argentatus—Herring gull.
- Eating frozen moose meat, Fauna 30, p. 84.
- Food at Marshall Hall, Bul. 17, pp. 53, 80.
- Food of young in captivity, Ybk. 1900, p. 434.

Larus atricilla—Laughing gull.
- Food of nestlings, Ybk. 1900, p. 434.

Larus brachyrhynchus—Short-billed gull.
- Feeding on water beetles (*Dytiscus dauricus*), Fauna 27, p. 268.
- Food of nestlings, Ybk. 1900, p. 434.

Larus californicus—California gull.
- Feeding on duck [probably carrion], Fauna 7, p. 14; field mice, Ybk. 1908, p. 194.

Larus delawarensis—Ring-billed gull.
- Feeding on field mice, Ybk. 1908, p. 194.
- Food at Marshall Hall, Bul. 17, pp. 53, 80.

Larus franklini—Franklin's gull.
- Feeding on crickets, Ybk. 1908, p. 194; grasshoppers, Rept. 1887, p. 431; Ybk. 1908, p. 194.
- Food of nestlings, Ybk. 1900, p. 434.
- Insectivorous, Rept. 1900, p. 37.

Larus glaucescens—Glaucous-winged gull.
- Feeding on dead salmon, Fauna 24, p. 53.

Larus heermanni—Heermann's gull.
- Feeding on fish they compelled gannets to disgorge, Fauna 14, p. 24.

Larus marinus—Great black-backed gull.
- Feeding on field mice in Europe, Bul. 31, p. 53.

Leucosticte tephrocotis—Gray-crowned rosy finch.
- Feeding on insects and seeds, Fauna 7, p. 82.

Ligurinus chloris, see Chloris chloris.

Limosa fedoa—Marbled godwit.
- Feeding on grasshoppers, Circ. 79, p. 4.

Limosa hæmastica—Hudsonian godwit.
- Feeding on horseflies, Circ. 79, p. 4.

Linaria cannabina—Old-world linnet.
- Injurious in New Zealand, Ybk. 1909, p. 257.

Linnet, California, see Carpodacus mexicanus frontalis.
- Old-world, see Linaria cannabina.

- Lobipes lobatus—Northern phalarope.
  - Feeding on click beetles, clover-root curculio, Circ. 79, p. 6; crane flies, Circ. 79, p. 4; Dytiscidæ, Circ. 79, p. 8; grasshoppers, Circ. 79, p. 4; mosquitoes, Circ. 79, p. 2; Rept. 1908, p. 577; *Nereis*, Circ. 79, p. 8; wireworms, Circ. 79, p. 6.
- Longspur, Chestnut-collared, see Calcarius ornatus.
  - Lapland, see Calcarius lapponicus.
  - McCown's, see Rhynchophanes mccowni.
  - Smith's, see Calcarius pictus.
- Loon, Black-throated, see Gavia arctica.
  - Red-throated, see Gavia stellata.
- Lophodytes cucullatus—Hooded merganser.
  - Brief account, Bul. 38, p. 17.
  - Food at Marshall Hall, Bul. 17, pp. 53, 81.
- Lophortyx californica—California quail.
  - Damage to fruit, Ybk. 1898, p. 231; grain, Ybk. 1897, p. 352.
  - Feeding on acorns, Fauna 7, p. 28; weed seeds, Ybk. 1898, p. 231.
  - Food in California, Bul. 34, pp. 9–14 (619 stomachs).
  - Formal report, Bul. 21, pp. 9, 47–56 (601 stomachs).
  - Killed by eating poisoned wheat, F. Bul. 352, p. 8.
  - Relation to fruit in California, Bul. 30, p. 13; Ybk. 1904, pp. 246, 250.
- Lophortyx gambeli—Gambel's quail.
  - Damage to fruit, Ybk. 1898, p. 231.
  - Feeding on waste grain, Fauna 7, p. 29; weed seeds, Ybk. 1898, p. 231.
  - Formal report, Bul. 21, pp. 56–58 (28 stomachs).
- Love bird, Tres Marias, see Psittacula insularis.
  - Feeding on seeds of pine and sunflower, Fauna 16, p. 123.
- Loxia curvirostra minor—Crossbill.
- Loxia leucoptera—White-winged crossbill.
  - Feeding on seeds of white spruce, Fauna 27, p. 417.
- Lunda cirrhata—Tufted puffin.
  - Food of nestlings, Ybk. 1900, p. 433.

M.

- Macrorhamphus griseus—Dowitcher.
  - Feeding on Dytiscidæ, Circ. 79, p. 8; grasshoppers, horseflies, Circ. 79, p. 4; *Nereis*, Circ. 79, p. 8.
- Magpie, see Pica pica hudsonia.
- Mallard, see Anas platyrhynchos.
- Mareca americana—Widgeon.
  - Brief account, Bul. 38, p. 18.
  - Food at Marshall Hall, Bul. 17, p. 81.
  - Vegetable food, Circ. 81, pp. 1, 8.
- Marila affinis—Little bluebill.
  - Food at Marshall Hall, Bul. 17, p. 81.
  - Vegetable food, Circ. 81, pp. 1, 8.
- Marila americana—Redhead.
  - Brief account, Bul. 38, p. 21.
  - Vegetable food, Circ. 81, pp. 1, 8, 12.
- Marila collaris—Ring-necked duck.
  - Brief account, Bul. 38, p. 21.
- Marila marila—Big bluebill.
  - Feeding on *Lymnæa*, Fauna 27, p. 283.
  - Vegetable food, Circ. 81, pp. 1, 8.
- Marila valisineria—Canvasback.
  - Brief account, Bul. 38, p. 21.
  - Food at Marshall Hall, Bul. 17, pp. 81, 82.
  - Vegetable food, Circ. 81, pp. 1, 7–8, 11–12.
- Martin, Old-world, see Chelidonaria urbica.
  - Purple, see Progne subis.
- Maryland yellowthroat, see Geothlypis trichas.
- Meadowlark, see Sturnella magna.
  - Western, see Sturnella neglecta.
- Megaquiscalus major—Boat-tailed blackbird.
  - Bounty laws, Ybk. 1896, p. 57.
  - Damage to corn, Bul. 29, p. 8; rice, Rept. 1886, pp. 246–247.
  - Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 9, 10, 12, 21; Bul. 29, pp. 6, 7, 11, 17–18, 29, 30; Circ. 64, p. 5.
  - Formal report, Bul. 13, pp. 9, 10, 70–72 (116 stomachs).
- Megascops asio, see Otus asio.
- Megascops flammeola, see Otus flammeolus.
- Melanerpes carolinus, see Centurus carolinus.
- Melanerpes erythrocephalus — Red-headed woodpecker.
  - Brief account, Bul. 38, p. 48; F. Bul. 54, pp. 8–9, 10; F. Bul. 54 (rev.), pp. 11–12, 13; Ybk. 1900, p. 295.
  - Damage to buildings, Bul. 39, p. 13; poles, Bul. 39, p. 10; posts, Bul. 39, p. 13.
  - Feeding on rose beetle, Bul. 32, p. 20; scale insects, Ybk. 1906, p. 197.
  - Food at Marshall Hall, Bul. 17, pp. 19, 43, 60, 61, 90.
  - Formal report, Bul. 7, pp. 8, 9, 10, 11, 20–25, 38 (101 stomachs); Bul. 37, pp. 10, 35–42 (443 stomachs).
  - Relation to orchards, Ybk. 1900, p. 295.
  - Tapping trees, Bul. 39, p. 91.
- Melanerpes formicivorus bairdi—California woodpecker.
  - Damage to buildings, Bul. 39, p. 14; poles, Bul. 39, p. 11; posts, Bul. 39, p. 13.
  - Feeding on acorns, Bul. 7, p. 20; Fauna 7, p. 50; grasshoppers, Fauna 7, p. 50; scale insects, Ybk. 1906, p. 194.
  - Food in California, Bul. 34, pp. 22–24, 28, 49 (75 stomachs).

- Melanerpes formicivorus bairdi—Continued.
  - Formal report, Bul. 37, pp. 10, **43–45**, 46 (84 stomachs).
  - Tapping trees, Bul. 39, p. 91.
  - Visiting sapsucker punctures, Bul. 39, p. 92.
- Melanerpes torquatus, see Asyndesmus lewisi.
- Meleagris gallopavo merriami—Merriam's turkey.
  - Feeding on gooseberries, piñon nuts, Fauna 3, p. 89; (*Pinus monophylla*) Fauna 7, p. 337.
- Meleagris gallopavo silvestris—Wild turkey.
  - Damage to grain, Bul. 24, p. 9.
  - Economic value, Ybk. 1902, p. 206.
  - Formal report, Bul. 24, pp. 48–52 (16 stomachs).
- Melospiza georgiana—Swamp sparrow.
  - Feeding on boll weevil, Circ. 64, pp. 3, 5.
  - Formal report, Bul. 15, p. 87 (72 stomachs).
- Melospiza lincolni—Lincoln's sparrow.
  - Formal report, Bul. 15, pp. 15, **86** (31 stomachs).
- Melospiza melodia—Song sparrow.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, Bul. 38, p. 66; F. Bul. 54, pp. **26–27, 28**; F. Bul. 54 (rev.), 31–32.
  - Feeding on insects, Bul. 1, pp. 295, 323; Fauna 21, p. 48; mulberries, Rept. 1890, p. 285; sand fleas, Fauna 21, p. 48; weed seeds, Ybk. 1898, pp. 222, 223, 224, 225, 226, 227.
  - Food at Marshall Hall, Bul. 17, pp. 16, 22, 23, 26, 27, 30, 32, 33, 34, 35, 36, 38, 39, 40, 59, 60, 61, 70, 71, 72, 73, 75, 77, 97 (36 stomachs).
  - Food in California, Bul. 34, pp. 84-86 (321 stomachs).
  - Formal report, Bul. 15, pp. 13, 15, 21, 24, 26, 27, 28, 31, 32, 37, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, **82–86** (401 stomachs).
- Merganser, Hooded, see Lophodytes cucullatus.
- Merula migratoria, see Planesticus migratorius.
- Micropalama himantopus—Stilt sandpiper.
  - Feeding on mosquitoes, Circ. 79, p. 2; *Nereis*, Circ. 79, p. 8.
- Micropallas whitneyi—Elf owl.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 3, pp. 11, **200–201**.
- Mimus polyglottos—Mocking bird.
  - Brief account, Bul. 38, p. 84; Ybk. 1900, p. 416.
  - Damage to fruit, Bul. 30, p. 53; Rept. 1890, p. 281.
- Mimus polyglottos—Continued.
  - Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 9, 14, 21; Bul. 29, pp. 6, 22, 23, 30; Bul. 38, p. 84, Circ. 64, p. 5; cotton worms, Bul. 25, pp. 20, 21.
  - Food at Marshall Hall, Bul. 17, pp. 34, 38, 62, **104**, 110.
  - Food in California, Bul. 30, pp. 52–55 (53 stomachs).
  - Food of nestlings, Ybk. 1900, p. 416.
  - Formal report, Ybk. 1895, pp. 405, 406, **415–416** (15 stomachs).
  - Reference to studies of food habits, Ybk. 1899, p. 266.
- Mniotilta varia—Black-and-white creeper.
  - Brief account, Bul. 38, p. 75.
- Mocking bird, see Mimus polyglottos.
- Molothrus ater—Cowbird.
  - Brief account, Bul. 38, p. 57.
  - Damage to fruit, Bul. 1, p. 246; grain, Rept. 1887, pp. 428, 429, 430–431; Rept. 1898, p. 39; Ybk. 1897, p. 352; Ybk. 1898, p. 222; rice, Bul. 38, p. 57.
  - Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 8, 9, 12, 21; Bul. 29, pp. 6, 7, 18, 28, 30; Circ. 64, p. 5; mulberries, Rept. 1890, p. 285; weed seeds, Bul. 29, p. 8; Ybk. 1898, p. 222.
  - Food at Marshall Hall, Bul. 17, pp. 14, 32, 35, 70, 71, 77, **95**, 111.
  - Formal report, Bul. 13, pp. 9, **22–30** (544 stomachs).
  - Other notes, Bul. 15, p. 29.
- Munia nisoria, see Padda oryzivora.
- Munia oryzivora, see Padda oryzivora.
- Murre, Pallas's, see Uria lomvia arra.
- Muscivora forficata—Scissor-tailed flycatcher.
  - Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 8, 13, 19, 20, 21; Bul. 29, pp. 6, 15, 26, 30; Circ. 64, p. 5.
- Myadestes townsendi—Solitaire.
  - Feeding on berries of *Juniperus occidentalis*, Fauna 16, pp. 123, 133, 139.
- Mycteria americana—Wood ibis.
  - Feeding on field mice, Bul. 31, p. 52.
- Myiarchus cinerascens—Ash-throated flycatcher.
  - Food in California, Bul. 34, pp. 29–32 (80 stomachs).
  - Other notes, Fauna 7, p. 60.
- Myiarchus crinitus—Crested flycatcher.
  - Brief account, Bul. 38, p. 53.
  - Feeding on boll weevil, Bul. 29, pp. 6, 14, 15, 23, 29, 30; Circ. 64, p. 5.
  - Food at Marshall Hall, Bul. 17, pp. 19–20, 23, 24, 29, 30, 32, 34, 35, 37, 38, 40, **93**.
  - Food of nestlings, Ybk. 1900, p. 426.
- Myiochanes richardsoni—Western wood pewee.
  - Feeding on flies (*Ephydra hians*), Fauna 7, p. 64.

Myiochanes richardsoni—Continued.
Food in California, Bul. 34, pp. 37, 39–41 (137 stomachs).
Myiochanes virens—Wood pewee.
Brief account, Bul. 38, p. 54; Ybk. 1900, p. 427.
Feeding on mulberries, Rept. 1890, p. 285.
Food at Marshall Hall, Bul. 17, pp. 19, 23, 24, 29, 30, 34, 35, 37, 40, 92 (11 stomachs).
Food of nestlings, Ybk. 1900, p. 427.
Myna, Common, see Acridotheres tristis.

N.

Nannus hiemalis—Winter wren.
Brief account, Bul. 30, pp. 65–66.
Feeding on boll weevil, Circ. 64, pp. 4, 5.
Food at Marshall Hall, Bul. 17, p. 107.
Nestor notabilis—Kea.
Killed soon after arrival in Hawaii because of reputation as sheep destroyer, Rept. 1904, pp. 296–297.
Nettion carolinense—Green-winged teal.
Brief account, Bul. 38, p. 19.
Vegetable food, Circ. 81, p. 1.
Nighthawk, see Chordeiles virginianus.
Texas, see Chordeiles acutipennis texensis.
Nucifraga columbiana—Clarke's crow.
Feeding on beetles, blueberries, caterpillars, grasshoppers, Fauna 16, pp. 119–121; piñon nuts, Fauna 3, p. 94; seeds of *Pinus albicaulis*, Fauna 16, p. 119.
Food of adults and nestlings, Ybk. 1900, p. 426.
Other notes, Fauna 5, pp. 18, 100.
Numenius americanus—Long-billed curlew.
Feeding on grasshoppers, Circ. 79, p. 2.
Numenius hudsonicus—Hudsonian curlew.
Feeding on crowberries (*Empetrum nigrum*), Fauna 27, p. 331; Ybk. 1903, p. 377.
Nun, Japanese, see Uroloncha acuticauda.
Nutcracker, Clarke's, see Nucifraga columbiana.
Nuthatch, Pygmy, see Sitta pygmaea.
Red-breasted, see Sitta canadensis.
White-breasted, see Sitta carolinensis.
Nuttallornis borealis—Olive-sided flycatcher.
Feeding on boll weevil, Bul. 29, pp. 6, 15, 24, 30; Circ. 64, p. 5.
Nyctala acadica, see Cryptoglaux acadica.
Nyctala tengmalmi richardsoni, see Cryptoglaux funerea richardsoni.
Nyctea nyctea—Snowy owl.
Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
Brief account, Circ. 61, pp. 3, 18; Ybk. 1894, pp. 217, 226.
Nyctea nyctea—Continued.
Feeding on brown rat, Bul. 33, p. 35; field mice, Bul. 31, p. 50; Ybk. 1905, p. 371; pocket gophers, Bul. 5, p. 21; rabbits, Ybk. 1907, p. 336; spermophiles, Bul. 4, pp. 15, 16; varying hares (*Lepus americanus*), Fauna 27, p. 375.
Formal report, Bul. 3, pp. 11, 182–187 (38 stomachs); Rept. 1887, p. 422 (6 stomachs).
Nycticorax nycticorax nævius—Black-crowned night heron.
Brief account, Bul. 38, p. 26; Ybk. 1900, p. 435.
Feeding on carp, Fauna 7, p. 20; field mice, Bul. 31, p. 52.
Food at Marshall Hall, Bul. 17, pp. 53, 81.
Food of nestlings, Ybk. 1900, p. 435.
Injurious to fish, hence exempt from protection in certain States, Bul. 12, p. 36; Bul. 12 (rev.), p. 43.

O.

Oceanodroma melania—Black petrel.
Feeding on refuse from vessel, Fauna 14, p. 28.
Oidemia americana—Scoter.
Feeding on newly sown millet, Bul. 2, p. 73.
Oidemia deglandi—White-winged scoter.
Feeding on wild celery, Circ. 81, p. 8.
Olbiorchilus hiemalis, see Nannus hiemalis.
Olor columbianus—Whistling swan.
Food at Marshall Hall, Bul. 17, p. 81.
Oreortyx picta—Mountain quail.
Formal report, Bul. 21, pp. 58–60 (23 stomachs).
Oreoscoptes montanus—Sage thrasher.
Feeding on buffalo berries, Fauna 33, p. 241.
Oreospiza chlorura—Green-tailed towhee.
Feeding on weed seeds, Ybk. 1898, p. 230.
Oriole, Baltimore, see Icterus galbula.
Bullock's, see Icterus bullocki.
Grayson's, see Icterus graysoni.
Orchard, see Icterus spurius.
Osprey, see Pandion haliaëtus carolinensis.
Otocoris alpestris—Horned lark.
Brief account, Rept. 1905, pp. 305–306.
Damage to grain, Ybk. 1897, p. 352; newly sown wheat, Fauna 7, p. 68.
Feeding on weed seeds, Ybk. 1898, pp. 222, 230, 232.
Food at Marshall Hall, Bul. 17, pp. 70, 71, 98.
Food in California, Bul. 23, pp. 9, 30–32 (267 stomachs); Bul. 34, pp. 44–47 (259 stomachs).
Food in Europe (of the subspecies flava) similar to that of American races, Bul. 23, p. 11.

Otocoris alpestris—Continued.
Formal report, Bul 23, pp. **7–37** (1,154 stomachs); Rept. 1892, pp. 193–197 (59 stomachs).
Killed by eating poisoned wheat, F. Bul. 352, p. 8.

Otus asio—Screech owl.
Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
Bounty laws, Ybk. 1899, p. 281.
Brief account, Bul. 31, pp. 49–50; Bul. 38, p. 43; Circ. 61, pp. 3, **12–13** (254 stomachs); Rept. 1889, pp. 372–376; Ybk. 1894, pp. 217, **225–226**; Ybk. 1900, p. 430.
Feeding on brown rat, Bul. 33, p. 34; buckwheat, Bul. 2, p. 121; English sparrow, Bul. 1, pp. 32, 150, 238; Rept. 1886, p. 245; field mice, Bul. 31, pp. 49–50; Ybk. 1905, p. 371; horned larks, Bul. 23, p. 12; seeds, wheat, Bul. 2, p. 121.
Food at Marshall Hall, Bul. 17, pp. 19, 32, 56, **86** (5 stomachs).
Food of nestlings, Ybk. 1900, p. 430.
Formal report, Bul. 3, pp. 11, 14, 146, **163–173** (254 stomachs); Rept. 1887, pp. 420–421 (94 stomachs).
Other notes, Bul. 1, pp. 32, 150, 238; Rept. 1886, p. 245.

Otus flammeolus—Flammulated screech owl.
Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
Brief account, Bul. 3, pp. 11, **173–174**; Rept. 1889, p. 376.
Feeding on beetles, other insects, and scorpion, Fauna 3, pp. 39, 91.

Ovenbird, see Seiurus aurocapillus.

Owl, American barn, see Aluco pratincola.
Barred, see Strix varia.
Burrowing, see Speotyto cunicularia hypogæa.
Elf, see Micropallas whitneyi.
Ferruginous pygmy, see Glaucidium phalœnoides.
Flammulated screech, see Otus flammeolus.
Florida burrowing, see Speotyto cunicularia floridana.
Great gray, see Scotiaptex nebulosa.
Great horned, see Bubo virginianus.
Hawk, see Surnia ulula caparoch.
Long-eared, see Asio wilsonianus.
Old-world barn, see Aluco flammeus.
Old-world long-eared, see Asio otus.
Pygmy, see Glaucidium gnoma.
Richardson's, see Cryptoglaux funerea richardsoni.
Saw-whet, see Cryptoglaux acadica.
Screech, see Otus asio.
Short-eared, see Asio flammeus.
Snowy, see Nyctea nyctea.
Spotted, see Strix occidentalis.

Oxyechus vociferus—Killdeer.
Feeding on army worm, billbugs, Circ. 79, p. 6; boll weevils, Bul. 22, pp. 15, 16; Bul. 25, pp. 8, 9, 14, 21; Bul. 29, pp. 6, 7, 11, 20–21, 27, 30; Circ. 57, p. 4; Circ. 64, p. 5; Circ. 79, p. 6; click beetles, clover-leaf beetle, clover-root curculio, corn-leaf beetle, cotton worm, cotton cutworm, Circ. 79, p. 6; crane flies, Circ. 79, p. 4; crayfishes, cutworms, Circ. 79, p. 6; Dytiscidæ, Circ. 79, p. 8; grapevine colaspis, Circ. 79, p. 6; grasshoppers, Circ. 79, p. 2; horseflies, Circ. 79, p. 4; mosquitoes, Circ. 79, p. 2; Rept. 1908, p. 577; *Nereis*, Circ. 79, p. 8; rice weevil, tobacco worm, wireworms, Circ. 79, p. 6.
Killed by eating poisoned grain, Ybk. 1908, p. 308.
Other notes, Bul. 22, pp. 15–16; Bul. 29, p. 27.

Oxeye, see Parus major.

P.

Padda oryzivora—Java sparrow.
Admission to Hawaii denied, Rept. 1909, p. 542.
Damages rice, Ybk. 1906, p. 177.
Injurious in Hawaii, Rept. 1902, p. 213.

Paddy bird, see Padda oryzivora.

Pandion haliaëtus carolinensis—Osprey.
Bounty laws, Ybk. 1899, pp. 266, 279, 280, 281.
Brief account, Bul. 38, p. 41.
Food at Marshall Hall, Bul. 17, pp. 19, 53.
Food of nestlings, Ybk. 1900, p. 430.
Formal report, Bul. 3, pp. 15, 16, **130–132** (12 stomachs).
Injurious, Bul. 38, p. 10.
Protected, or excepted from bounty laws in certain States, Bul. 12, p. 29; Bul. 12 (rev.), p. 32; Ybk. 1899, pp. 266, 279.

Parabuteo unicinctus harrisi—Harris's hawk.
Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
Feeding on cotton rat (*Sigmodon hispidus texianus*), Fauna 25, p. 116; rabbits, Ybk. 1907, p. 336; spermophiles, Bul. 4, pp. 16, 17; wood rat (*Neotoma micropus*), Fauna 25, p. 112.
Formal report, Bul. 3, pp. 11, **47–48** (6 stomachs).

Paroquet, Carolina, see Conuropsis carolinensis.

Parrot, Double yellow-headed, see Amazona oratrix.
Mountain, see Nestor notabilis.

Partridge, European common, see Perdix perdix.
  - Hungarian, see Perdix perdix.
  - Spruce, see Canachites canadensis.

Parus atricapillus, see Penthestes atricapillus.

Parus bicolor, see Bæolophus bicolor.

Parus cæruleus, see Cyanistes cæruleus.

Parus carolinensis, see Penthestes carolinensis.

Parus gambeli, see Penthestes gambeli.

Parus inornatus, see Bæolophus inornatus.

Parus major—Great titmouse.
  - Admission denied, Rept. 1902, p. 213; Ybk. 1905, p. 545.
  - Economic status, introduction dangerous, etc., Rept. 1899, p. 67; Ybk. 1898, pp. 90, 104–105, 107, 109, 110.

Parus palustris, see Pœcile palustris.

Parus rufescens, see Penthestes rufescens.

Parus wollweberi, see Bæolophus wollweberi.

Passer domesticus—English sparrow.
  - Admission denied, Circ. 34, p. 7; F. Bul. 160, p. 48; F. Bul. 180, p. 42; F. Bul. 470, p. 301; Rept. 1900, p. 41.
  - Admission to West Australia prohibited, Rept. 1899, p. 68.
  - Bounty laws, Circ. 17, p. 4; Rept. 1899, p. 65; Ybk. 1896, pp. 55, 58, 59, 60, 61, 66, 67; Ybk. 1899, p. 265.
  - Brief account, Bul. 9, pp. 17, 18, 20; Bul. 38, p. 60; F. Bul. 383, p. 5; Ybk. 1900, pp. 420–422.
  - Driving other birds away, Bul. 29, p. 11; Ent. Circ. 20 [p. 2]; Circ. 2 [p. 1]; Circ. 56, pp. 2, 3; Circ. 57, pp. 3–4; F. Bul. 383, p. 6; Rept. 1907, p. 486; Schedule 4 [p. 1].
  - Economic status, introduction dangerous, etc., F. Bul. 160, p. 48; F. Bul. 180, p. 42; Rept. 1886, p. 258; Rept. 1906, pp. 406, 415; Rept. 1907, p. 493; Ybk. 1898, pp. 90, 98–101, 104, 108, 109, 110; Ybk. 1899, pp. 287, 290, 292; Ybk. 1904, p. 515; Ybk. 1905, p. 546; Ybk. 1909, p. 249.
  - Feeding on mulberries, Rept. 1890, p. 285; potato beetle, Bul. 32, p. 47; scale insects, Ybk. 1906, pp. 191, 196; weed seeds, Ybk. 1898, pp. 223–224, 225, 232.
  - Food habits at Marshall Hall, Bul. 17, pp. 17, 23, 24, 28, 30, 34, 36, 38, 56, 61, 66, 68–69, 70, 98, 110 (53 stomachs).
  - Food of nestlings, Ybk. 1900, pp. 420–422, 436.
  - Formal report, Bul. 1, pp. 1–405 (636 stomachs); Bul. 15, pp. 15, 17, 21, 26, 27, 31, 32, 34, 39, 40, 48, 49, 50, 92–96 (798 stomachs); Rept. 1886, pp. 235–246.

Passer domesticus—Continued.
  - Injurious, Bul. 12, pp. 13, 35, 36; Bul. 12 (rev.), pp. 20, 21, 42; Bul. 31, pp. 38, 43, 45, 60; F. Bul. 160, p. 48; F. Bul. 180, p. 42; F. Bul. 470, p. 30; Rept. 1886, p. 258; Rept. 1889, p. 374; Rept. 1891, p. 271; Rept. 1899, pp. 68–69; Rept. 1901, p. 160; Rept. 1906, pp. 406, 415; Rept. 1907, pp. 500–501; Ybk. 1895, p. 418; Ybk. 1897, p. 670; Ybk. 1898, pp. 223, 232; Ybk. 1904, p. 515; Ybk. 1905, p. 546; Ybk. 1907, pp. 173–174, 177; Ybk. 1909, p. 249.
  - Injurious in Australasia, Rept. 1899, pp. 68–69; Hawaii, Rept. 1902, p. 213; Ybk. 1899, p. 290; India, Bul. 1, p. 303.
  - Methods of destroying, F. Bul. 383, pp. 6–11; Rept. 1887, pp. 423–426; Rept. 1899, p. 66.
  - Other notes, Rept. 1887, pp. 400–401, 424–426; Rept. 1891, p. 271; Rept. 1899, p. 66; Rept. 1907, pp. 493, 500–501; Rept. 1908, pp. 577–578, 586–587; Rept. 1909, pp. 539–540; Ybk. 1895, p. 418.
  - Reference to studies of food habits, Ybk. 1899, pp. 264–265, 266, 291.
  - Repressive measures employed in California, Rept. 1908, pp. 577–578, 586–587; Rept. 1909, pp. 539–540.
  - Request for information on economic relations, Ent. Circ. 20 [p. 2]; Circ. 2 [p. 1]; Rept. 1886, p. 231; Schedule 4 [1].
  - Sparrow hunts, Ybk. 1896, p. 67.

Passer hispaniolensis—Spanish sparrow.
  - Injurious in Algeria, Bul. 1, p. 302.

Passer indicus, see Passer domesticus (Injurious in India).

Passer montanus—Tree sparrow.
  - Economic status and introduction, Bul. 1, pp. 191–194; Ybk. 1899, pp. 287–288.

Passerculus princeps—Ipswich sparrow.
  - Formal report, Bul. 15, p. 59 (56 stomachs).

Passerculus sandwichensis—Savanna sparrow.
  - Brief account, Bul. 38, p. 62.
  - Feeding on boll weevil, Bul. 22, pp. 11, 16; Bul. 25, pp. 9, 21; Bul. 29, pp. 6, 19, 27, 28, 30; Bul. 38, pp. 9, 62; Circ. 64, pp. 3, 4, 5.
  - Food at Marshall Hall, Bul. 17, pp. 15, 30, 32, 35, 38, 71, 73.
  - Formal report, Bul. 15, pp. 37, 59–61, 90 (119 stomachs).
  - Insectivorous, Bul. 1, p. 323.

Passerella iliaca—Fox sparrow.
  - Feeding on boll weevil, Circ. 64, pp. 3, 5; weed seeds, Bul. 15, p. 27; F. Bul. 54, p. 28; F. Bul. 54 (rev.), p. 32; Ybk. 1898, pp. 222, 226, 227.

Passerella iliaca—Continued.
  Food at Marshall Hall, Bul. 17, pp. 16, 77.
  Formal report, Bul. 15, pp. 27, 28, 37, 42, 43, 74, 83, **87–89** (127 stomachs).
Passerherbulus caudacutus—Sharp-tailed sparrow.
  Formal report, Bul. 15, pp. 64–65.
Passerherbulus henslowi—Henslow's sparrow.
  Food at Marshall Hall, Bul. 17, pp. 32, 35, 38, 39.
  Formal report, Bul. 15, pp. 24, **63–64** (7 stomachs).
Passerherbulus maritimus — Seaside sparrow.
  Formal report, Bul. 15, pp. 65–66 (30 stomachs).
Passerherbulus nelsoni—Nelson's sparrow.
  Formal report, Bul. 15, pp. 64–65.
Passerina ciris—Painted bunting.
  Feeding on boll weevil, Bul. 25, pp. 9, 12, 17, 18, 20–21; Bul. 29, pp. 6, 9, 19, 30; Bul. 38, p. 9; Circ. 64, p. 5.
Passerina cyanea—Indigo bunting.
  Brief account, Bul. 38, pp. 9, 68.
  Food at Marshall Hall, Bul. 17, p. 98.
Passerina nivalis, see Plectrophenax nivalis.
Pediœcetes phasianellus — Sharp-tailed grouse.
  Favorite vegetable foods, Ybk. 1909, p. 194.
  Feeding on ants, barley, beetles, Fauna 27, p. 350; berries of *Viburnum pauciflorum*, catkins of alders (*Alnus alnobetula* and *A. incana*), Fauna 27, p. 349; leaves, myriapods, Fauna 27, p. 350; potato beetle, Bul. 32, p. 47.
  Formal report, Bul. 24, pp. **20–23** (43 stomachs).
Peep, see Ereunetes pusillus.
Pelecanus fuscus, see Pelecanus occidentalis.
Pelecanus occidentalis—Brown pelican.
  Food of nestlings, Ybk. 1900, pp. 434–435.
Pelican, Brown, see Pelecanus occidentalis.
Pelidna alpina sakhalina—Red-backed sandpiper.
  Feeding on Dytiscidæ, *Nereis*, Circ. 79, p. 8.
Penthestes atricapillus—Black-capped chickadee.
  Beneficial, Ybk. 1897, p. 670.
  Brief account, F. Bul. 54 (rev.), pp. 43–44 (289 stomachs); Ybk. 1900, pp. 295–296.
  Feeding on eggs of fall cankerworms, Bul. 17, p. 108; larvæ of codling moth (probably), Ybk. 1898, p. 105; plant lice, Bul. 17, p. 108; scale insects, Ybk. 1906, p. 197.
Penthestes atricapillus—Continued.
  Reference to studies of food habits, Ybk. 1899, pp. 263–264.
  Relations to orchards, Ybk. 1900, pp. 295–296.
Penthestes carolinensis—Carolina chickadee.
  Brief account, Bul. 38, p. 89.
  Feeding on boll weevil, Circ. 64, pp. 4, 5; scale insects, Ybk. 1906, p. 197; seeds of ragweed, Bul. 15, p. 42.
  Food at Marshall Hall, Bul. 17, pp. 20, 23, 24, 34, 35, 39, 60, 71, 77, **107–108** (7 stomachs).
  Other notes, F. Bul. 54 (rev.), p. 44.
Penthestes gambeli—Mountain chickadee.
  General nature of food, Bul. 30, p. 71.
Penthestes rufescens — Chestnut-backed chickadee.
  Feeding on scale insects, Ybk. 1906, p. 194.
  Food in California, Bul. 30, pp. 70–71 (57 stomachs).
Perdix perdix—European common partridge.
  Brief account, Ybk. 1909, p. 252.
Perisoreus canadensis—Canada jay.
  Feeding on carrion, Fauna 30, p. 89; crowberries (*Empetrum nigrum*), Fauna 27, p. 401; refuse and scraps of meat about camp, Fauna 24, p. 71; Fauna 30, pp. 40, 62.
  Other notes, Fauna 5, p. 18; Fauna 30, p. 89.
  Useful as scavengers, Fauna 30, p. 61.
Petrel, Black, see Oceanodroma melania.
Petrochelidon lunifrons—Cliff swallow.
  Beneficial, Bul. 1, p. 89.
  Brief account, Bul. 38, p. 70; F. Bul. 54, p. 31; F. Bul. 54 (rev.), pp. 36–38.
  Feeding on boll weevil, Bul. 29, pp. 6, 12–13, 24–25, 30; Bul. 38, p. 70; Circ. 64, p. 5.
  Food in California, Bul. 30, pp. 28–30 (123 stomachs).
  Protection urged, as enemy of boll weevil, Circ. 56, pp. 1, 2, 3, 4; Circ. 57, pp. 1, 2.
  Relation to bedbugs, Bul. 29, pp. 8, 13; Circ. 56, p. 2; Circ. 57, p. 2; bees, Rept. 1904, p. 294.
Pewee, Western wood, see Myiochanes richardsoni.
    Wood, see Myiochanes virens.
Phainopepla nitens—Phainopepla.
  Damage to fruit, Bul. 32, p. 61.
  Feeding on insects, mistletoe berries, Fauna 7, p. 113.
Phalacrocorax auritus—Double-crested cormorant.
  Feeding on fish, Bul. 38, p. 16.
Phalacrocorax urile—Red-faced cormorant.
  Food of nestlings, Ybk. 1900, p. 434.
Phalarope, Northern, see Lobipes lobatus.
    Wilson's, see Steganopus tricolor.

- Phalaropus lobatus, see Lobipes lobatus.
- Phaleris psittacula—Paroquet auklet.
  - Food of nestlings, Ybk. 1900, p. 433.
- Phasianus colchicus—Common pheasant.
  - Feeding on galls, Bul. 24, p. 31.
- Phasianus torquatus—Ring-necked pheasant.
  - Damage to gardens and grain, Rept. 1888, pp. 486, 487, 488; Ybk. 1897, pp. 352–353.
  - Food of young in captivity, Ybk. 1900, p. 432.
- Pheasant, Common, see Phasianus colchicus.
  - English, see Phasianus colchicus.
  - Ring-necked, see Phasianus torquatus.
- Philohela minor—Woodcock.
  - Brief account, Ybk. 1900, p. 432; Ybk. 1901, p. 449.
  - Feeding on click beetles, Circ. 79, p. 6; crane flies, Circ. 79, p. 4; cutworms, Circ. 79, p. 6; grasshoppers, Circ. 79, p. 4; wireworms, Circ. 79, p. 6.
  - Food at Marshall Hall, Bul. 17, pp. 19, 21, 24, 38, 82–83.
  - Food of nestlings, Ybk. 1900, p. 432.
- Phlœotomus pileatus—Pileated woodpecker.
  - Brief account, Bul. 38, p. 48.
  - Distributing poison Rhus seeds, Rept. 1890, p. 283.
  - Formal report, Bul. 7, pp. 8, 10, 11, 32, 38, 39 (23 stomachs); Bul. 37, pp. 10, 33–35 (80 stomachs).
  - Relation to trees, Bul. 39, p. 8.
- Phœbe, see Sayornis phœbe.
  - Black, see Sayornis nigricans.
  - Say's, see Sayornis sayus.
- Pica pica hudsonia—Magpie.
  - Feeding on carrion, Fauna 5, p. 99; field mice (*Microtus montanus*), F. Bul. 335, p. 12.
  - Killed by eating poisoned grain, F. Bul. 352, p. 8; Ybk. 1908, p. 308.
  - Other notes, Fauna 5, p. 18; Fauna 19, p. 80.
- Picicorvus columbianus, see Nucifraga columbiana.
- Picoides americanus — Three-toed woodpecker.
  - Brief account, Bul. 7, p. 33.
  - Formal report, Bul. 37, pp. 10, 11, 25–27 (23 stomachs).
- Picoides arcticus—Arctic three-toed woodpecker.
  - Brief account, Bul. 7, p. 33.
  - Feeding on scale insects, Ybk. 1906, p. 197.
  - Formal report, Bul. 37, pp. 10, 11, 25–27 (28 stomachs).
- Pigeon, Band-tailed, see Columba fasciata.
  - Common, see Columba livia.
  - Passenger, see Ectopistes migratorius.
  - Tres Marias, see Columba flavirostris madrensis.
- Pigeon, Wild, see Ectopistes migratorius.
  - Wood, see Columba palumbus.
- Pinicola enucleator alascensis—Alaska pine grosbeak.
  - Feeding on seeds of alder (*Alnus alnobetula*), Fauna 27, p. 415; dwarf birch (*Betula nana*), Fauna 27, p. 414.
- Pinicola enucleator leucura—Pine grosbeak.
  - Brief account, Bul. 32, p. 5.
- Pintail, see Dafila acuta.
- Pipilo crissalis—California towhee.
  - Feeding on scale insects, Ybk. 1906, p. 194; weed seeds, Ybk. 1898, p. 230.
  - Food in California, Bul. 34, pp. 89–93 (399 stomachs).
- Pipilo erythrophthalmus—Towhee.
  - Brief account, Bul. 38, p. 67.
  - Feeding on boll weevil, Bul. 29, pp. 6, 20, 28, 30; Circ. 64, p. 5; weed seeds, Ybk. 1898, p. 230.
  - Food at Marshall Hall, Bul. 17, pp. 30, 34, 35, 38, 98.
  - Food of nestlings, Ybk. 1900, p. 418.
- Pipilo maculatus megalonyx—Spurred towhee.
  - Feeding on scale insects, Ybk. 1906, p. 194.
- Pipilo maculatus subspecies—Spotted towhees.
  - Food in California, Bul. 34, pp. 86–89 (139 stomachs).
- Pipit, see Anthus rubescens.
- Piranga bidentata flammea—Tres Marias tanager.
  - Feeding on wild fig, Fauna 14, p. 61.
- Piranga erythromelas—Scarlet tanager.
  - Brief account, Bul. 38, p. 69; Ybk. 1900, pp. 418–419.
  - Feeding on mulberries, Rept. 1890; p. 285; potato beetle, Bul. 32, p. 47.
  - Food at Marshall Hall, Bul. 17, pp. 20, 29, 30, 39, 40, 98.
  - Food of nestlings, Ybk. 1900, pp. 418–419.
- Piranga ludoviciana—Western tanager.
  - Damage to fruit, Bul. 32, p. 61.
  - Feeding on beetle, Fauna 7, p. 108; caterpillars, Fauna 16, p. 127.
  - Food in California, Bul. 30, pp. 9, 23–26 (46 stomachs).
  - Other notes, Fauna 14, p. 52.
  - Relation to fruit in California, Ybk. 1904, p. 242.
- Piranga rubra—Summer tanager.
  - Brief account, Bul. 38, p. 70.
  - Food at Marshall Hall, Bul. 17, pp. 40, 60, 61, 98.
- Pisobia bairdi—Baird's sandpiper.
  - Feeding on clover root curculio, Circ. 79, p. 6; crane flies, Circ. 79, p. 4; cutworms, Circ. 79, p. 6; grasshoppers, Circ. 79, p. 4; mosquitoes, Circ. 79, p. 2.

- Pisobia fuscicollis — White-rumped sandpiper.
  - Feeding on clover root curculio, Circ. 79, p. 6; grasshoppers, Circ. 79, p. 4.
- Pisobia maculata—Pectoral sandpiper.
  - Feeding on bill-bugs, click beetles, clover root curculio, corn-leaf beetle, Circ. 79, p. 6; crane flies, Circ. 79, p. 2; cutworms, Circ. 79, p. 6; Dytiscidæ, Circ. 79, p. 8; horseflies, Circ. 79, p. 4; mosquitoes, Circ. 79, p. 2; wireworms, Circ. 79, p. 6.
- Pisobia minutilla—Least sandpiper.
  - Feeding on grasshoppers, Circ. 79, p. 4; mosquitoes, Circ. 79, p. 2.
- Planesticus graysoni—Tres Marias robin.
  - Feeding on wild fig, Fauna 14, p. 61.
- Planesticus migratorius—Robin.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, Bul. 12, p. 23; Bul. 12 (rev.), pp. 29–30; Bul. 38, p. 92; F. Bul. 54, pp. 37–38 (330 stomachs); F. Bul. 54 (rev.), pp. 44–46 (500 stomachs); Ybk. 1900, pp. 303, 304, 413; Ybk. 1907, pp. 168–169, 175, 178.
  - Damage to fruit, Bul. 30, pp. 11, 20; Rept. 1901, p. 153; Ybk. 1904, pp. 243, 244, 252–253; Ybk. 1907, pp. 168–169, 175, 178; grapes, Bul. 1, pp. 53, 270, 324.
  - Feeding on buffalo berries, Fauna 7, p. 147, cankerworm moths, Bul. 1, p. 110; cherries, Bul. 1, p. 60; Bul. 32, p. 91; crowberries, Fauna 27, p. 497; cutworms, Bul. 1, p. 286; earthworms, Bul. 1, pp. 86, 94, 264, 275, 297, 305; Ybk. 1895, p. 411; gipsy moth, Rept. 1910, p. 553; mulberries, Bul. 32, p. 65; Rept. 1890, p. 285; peaches, pears, Bul. 1, p. 270; peas, Bul. 1, p. 60; potato beetle, Bul. 32, p. 47; tussock moth caterpillar, Bul. 1, pp. 108, 109, 324; Rept. 1886, p. 244; snowberry (probably), wild grape, Bul. 2, p. 290.
  - Food at Marshall Hall, Bul. 17, pp. 14, 32, 35, 37, 38, 43, 59, 62, 108–109 (9 stomachs).
  - Food in California, Bul. 30, pp. 9, 20, 23, 93–97 (74 stomachs).
  - Food of nestlings, Ybk. 1900, pp. 411, 413, 436.
  - Insectivorous, Bul. 12, p. 14; Bul. 12 (rev.), p. 22; Bul. 38, p. 9.
  - Other notes, Bul. 1, pp. 126, 304; Bul. 30, pp. 11, 20, 94; Ybk. 1908, p. 346.
  - Reference to studies of food habits, Ybk. 1899, pp. 261–262, 263, 264, 266.
  - Relation to fruit in California, Bul. 30, p. 20, Rept. 1901, p. 153; Ybk. 1904, pp. 243, 252–253.
- Planesticus migratorius—Continued.
  - Relation to orchards, Ybk. 1900, pp. 303, 304; Ybk. 1907, pp. 168–169, 175–178.
  - Request for information on economic relations, Ent. Circ. 20 [p. 2].
  - Robbed of food by English sparrow, Bul. 1, pp. 86, 94, 264, 275, 286, 297, 305.
- Plectrophenax nivalis—Snow bunting.
  - Feeding on seeds of grasses, Fauna 27, p. 421; and weeds, Fauna 27, p. 421; Ybk. 1898, pp. 222, 226, 227.
  - Formal report, Bul. 15, pp. 25, 27, 28, 45, 51–54 (46 stomachs).
  - Pulling wheat, Bul. 23, p. 16.
- Plover, Black-bellied, see Squatarola squatarola.
  - Golden, see Charadrius dominicus.
  - Mountain, see Podasocys montanus.
  - Piping, see Ægialitis meloda.
  - Ringed, see Ægialitis hiaticula.
  - Semipalmated, see Ægialitis semipalmata.
  - Snowy, see Ægialitis nivosa.
  - Upland, see Bartramia longicauda.
- Podasocys montanus—Mountain plover.
  - Feeding on grasshoppers, Circ. 79, p. 2.
- Podilymbus podiceps—Pied-billed grebe.
  - Food at Marshall Hall, Bul. 17, p. 79.
  - Harmless, Bul. 38, p. 14.
- Pœcile palustris—Marsh titmouse.
  - Feeding on scale insects, Ybk. 1906, p. 191.
- Polioptila cærulea—Blue-gray gnatcatcher.
  - Brief account, Bul. 38, p. 90.
  - Food at Marshall Hall, Bul. 17, pp. 24, 34, 108.
  - Food in California, Bul. 30, pp. 84–86 (30 stomachs).
- Polioptila californica—Black-tailed gnatcatcher.
  - Feeding on scale insects, Ybk. 1906, pp. 194, 198.
  - Food in California, Bul. 30, pp. 84–86 (30 stomachs).
- Polyborus cheriway—Caracara.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 3, pp. 11, 128–129.
  - Feeding on carrion, Bul. 2, p. 120; jack rabbits, Bul. 8, p. 44; prairie dogs, Bul. 2, p. 120.
  - Food on Tres Marias Islands, carrion, iguanas, Fauna 14, p. 39; and *Lepus graysoni*, Fauna 14, p. 17.
- Polyborus tharus—Carancho.
  - Attempting to carry off wounded duck, Bul. 3, p. 128.
- Poœcetes gramineus—Vesper sparrow.
  - Feeding on boll weevil, Circ. 64, pp. 3, 5; weed seeds, Ybk. 1898, pp. 226, 227, 229.
  - Food at Marshall Hall, Bul. 17, p. 15.

Poœcetes gramineus—Continued.
Formal report, Bul. 15, pp. 28, 37, 45, **56–58**, 92 (130 stomachs).
Porzana carolina—Sora.
Food at Marshall Hall, Bul. 17, pp. 19, **81**.
Prairie chicken, see Tympanuchus americanus.
Lesser, see Tympanuchus pallidicinctus.
Progne subis—Purple martin.
Brief account, Bul. 38, p. 70; Bul. 30, p. 27; F. Bul. 54, p. 31; F. Bul. 54 (rev.), pp. 5, **36–38**.
Feeding on boll weevil, Bul. 29, pp. 6, 9, 14, 25, 30; Bul. 38, p. 70; Circ. 64, p. 5.
Food at Marshall Hall, Bul. 17, pp. 20, 24, 25, 39, 40, **47**, **98–99**.
Food of nestlings, Ybk. 1900, p. 417.
Insectivorous, Bul. 38, p. 9; Bul. 1, p. 96.
Nesting boxes, Bul. 29, pp. 9–11.
Other notes, Bul. 1, p. 274.
Prepared food, Circ. 56, p. 3.
Protection urged, as enemy of boll weevil, Circ. 56, pp. 1, 3–4; Circ. 57, pp. 2, 3, 4.
Protonotaria citrea—Prothonotary warbler.
Insectivorous, Bul. 38, p. 75.
Psaltriparus minimus—Bushtit.
Brief account, F. Bul. 54 (rev.), p. 44 (66 stomachs); Ybk. 1900, p. 296.
Feeding on noxious insects, Ybk. 1904, p. 253; scale insects, Ybk. 1906, pp. 194, 195, 198.
Food in California, Bul. 30, pp. 74–80 (353 stomachs).
Relation to orchards, Ybk. 1900, p. 296.
Pseudogryphus californianus, see Gymnogyps californianus.
Psittacula insularis—Tres Marias love bird.
Feeding on wild fig, Fauna 14, pp. 41, 61.
Ptarmigan, Rock, see Lagopus rupestris.
White-tailed, see Lagopus leucurus.
Willow, see Lagopus lagopus.
Puffin, Horned, see Fratercula corniculata.
Tufted, see Lunda cirrhata.
Pyrrhuloxia sinuata—Gray grosbeak.
Brief account, F. Bul. 456, p. 12.
Feeding on boll weevil, Bul. 25, pp. 9, 12, 18, 21; Bul. 29, pp. 6, 19, 30; Circ. 64, p. 5.
Formal report, Bul. 32, pp. **28–33**, 90, 91 (74 stomachs).

Q.

Quail, California, see Lophortyx californica.
Gambel's, see Lophortyx gambeli.
Mearns's, see Cyrtonyx montezumæ mearnsi.
Mountain, see Oreortyx picta.
Scaled, see Callipepla squamata.
Querquedula discors—Blue-winged teal.
Brief account, Bul. 38, p. 19.
Vegetable food, Circ. 81, p. 1.

Quiscalus major, see Megaquiscalue major.
Quiscalus quiscula—Crow blackbird.
Brief account, Bul. 38, p. 60; F. Bul. 54, pp. 4, **24–26** (2,258 stomachs); F. Bul. 54 (rev.), pp. 4, 25, **29–30** (2,346 stomachs); Rept. 1887, pp. 428, 429, 430; Rept. 1890, p. 279; Ybk. 1897, pp. 348–349; Ybk. 1900, pp. 412, 423.
Damage to corn, Bul. 17, p. 96; Bul. 29, p. 8; grain, Rept. 1887, pp. 428, 429, 430; Rept. 1889, pp. 368–369; Rept. 1898, p. 39; Ybk. 1897, pp. 348–349; Ybk. 1898, p. 230.
Feeding on boll weevil, Bul. 29, pp. 6, 7, 8, 11, 17, 27, 30; Bul. 38, p. 60; Circ. 64, p. 5; eggs and young of other birds, Rept. 1888, p. 514; English sparrows, Bul. 1, p. 32; mulberries, Rept. 1890, p. 285; rose beetle, Bul. 32, p. 20; weed seeds, Ybk. 1898, pp. 222, 230.
Food at Marshall Hall, Bul. 17, pp. 14, 21, 23, 24, 30, 32, 35, 37, **47–48**, **49**, 55, 56, 59, 60, **66–68**, 70, 71, 77, **96**, 110 (25 stomachs).
Food of nestlings, Ybk. 1900, pp. 412–413, 423–424, 436.
Formal report, Bul. 13, pp. 8, 9, 10, **53–70** (2,346 stomachs); Ybk. 1894, pp. 233–248 (2,258 stomachs).
Injurious to grain, hence unprotected in certain States, Bul. 12, pp. 36, 37; Bul. 12 (rev.), p. 43.
Other notes, Bul. 15, p. 29; Ybk. 1898, p. 104.
Reference to studies of food habits, Ybk. 1899, pp. 263, 264, 265, 266.
Requests for information on economic value, Ent. Circ. 20 [p. 1]; Circ. 1 [p. 2]; Rept. 1886, p. 230.

R.

Raven, Northern, see Corvus corax principalis.
Old-world, see Corvus corax corax.
Southern, see Corvus corax sinuatus.
White-necked, see Corvus cryptoleucus.
Recurvirostra americana—Avocet.
Feeding on billbugs, cutworms, Circ. 79, p. 6; Dytiscidae, Circ. 79, p. 8; grasshoppers, Circ. 79, p. 4.
Redbird, see Cardinalis cardinalis.
Redhead, see Marila americana.
Redpoll, see Acanthis linaria.
Hoary, see Acanthis hornemanni exilipes.
Redstart, see Setophaga ruticilla.
Regulus calendula—Ruby-crowned kinglet.
Feeding on scale insects, Ybk. 1906, pp. 197, 198.

- Regulus calendula—Continued.
  - Food at Marshall Hall, Bul. 17, pp. 20, 108.
  - Food in California, Bul. 30, pp. 48, 81–84 (294 stomachs).
  - Other notes, Ybk. 1904, p. 254.
- Regulus satrapa—Golden-crowned kinglet.
  - Food at Marshall Hall, Bul. 17, pp. 20, 108.
  - Food in California, Bul. 30, p. 84 (9 stomachs).
  - Other notes, Bul. 9, p. 18; Ybk. 1904, p. 254.
- Rhynchophanes mccowni—McCown's longspur.
  - Feeding on weed seeds, Ybk. 1898, p. 226.
- Ricebird [American], see Dolichonyx oryzivorus.
  - [Javan], see Padda oryzivora.
- Ringneck, see Ægialitis semipalmata.
- Riparia riparia—Bank swallow.
  - Brief account, Bul. 38, p. 71; Ybk. 1900, p. 418.
  - Feeding on ants, Bul. 15, p. 32; bayberries, Rept. 1890, p. 282; boll weevil, Bul. 29, pp. 6, 14, 24, 25, 30; Bul. 38, p. 71; Circ. 56, pp. 1–2; Circ. 57, p. 2; Circ. 64, p. 5.
  - Food at Marshall Hall, Bul. 17, pp. 24, 25, 33, 34, 35, 36, 39, 40, 46–47, 98–99 (6 stomachs).
  - Food of nestlings, Ybk. 1900, p. 418.
  - Other notes, Bul. 30, p. 27.
  - Protection urged as enemy of boll weevil, Circ. 56, pp. 1–2; Circ. 57, p. 2.
- Rissa tridactyla pollicaris—Pacific kittiwake.
  - Food of nestlings, Ybk. 1900, pp. 433–434.
- Road runner, see Geococcyx californianus.
- Robin [of the United States], see Planesticus migratorius.
  - Tres Marias, see Planesticus graysoni.
- Rook, see Corvus frugilegus.
- Rostrhamus sociabilis—Everglade kite.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 3, pp. 11, 25–26; Circ. 61, pp. 3, 4; Ybk. 1894, pp. 217, 218.

S.

- Sage hen, see Centrocercus urophasianus.
- Salpinctes obsoletus—Rock wren.
  - Note on general nature of food, Bul. 30, pp. 65–66.
- Sandpiper, Baird's, see Pisobia bairdi.
  - Buff-breasted, see Tryngites subruficollis.
  - Least, see Pisobia minutilla.
  - Pectoral, see Pisobia maculata.
  - Purple, see Arquatella maritima.
  - Red-backed, see Pelidna alpina sakhalina.
  - Semipalmated, see Ereunetes pusillus.
  - Solitary, see Helodromas solitarius.
  - Spotted, see Actitis macularia.
  - Stilt, see Micropalama himantopus.
  - White-rumped, see Pisobia fuscicollis.
- Sapsucker, Red-breasted, see Sphyrapicus ruber.
  - Williamson's, see Sphyrapicus thyroideus.
  - Yellow-bellied, see Sphyrapicus varius.
- Sayornis nigricans—Black phœbe.
  - Brief account, F. Bul. 54 (rev.), pp. 17–18 (119 stomachs).
  - Food in California, Bul. 34, pp. 36–39 (333 stomachs).
- Sayornis phœbe—Phœbe.
  - Brief account, Bul. 38, p. 53; F. Bul. 54, pp. 13–14 (80 stomachs); F. Bul. 54 (rev.), pp. 16–17 (156 stomachs); Ybk. 1900, p. 426.
  - Feeding on boll weevil, Bul. 22, pp. 10, 16; Bul. 25, pp. 8, 13, 21; Bul. 29, pp. 6, 15, 26, 30; Bul. 38, p. 53; Circ. 64, p. 5; mulberries, Rept. 1890, p. 285; rose beetle, Bul. 32, p. 20.
  - Food at Marshall Hall, Bul. 17, pp. 23, 24, 30, 32, 33, 34, 37, 38, 40, 61, 92–93.
  - Food of nestlings, Ybk. 1900, pp. 426–427.
- Sayornis sayus—Say's phœbe.
  - Food in California, Bul. 34, pp. 35–36 (86 stomachs).
- Scolecophagus carolinus, see Euphagus carolinus.
- Scolecophagus cyanocephalus, see Euphagus cyanocephalus.
- Scoter, see Oidemia americana.
  - White-winged, see Oidemia deglandi.
- Scotiaptex cinerea, see Scotiaptex nebulosa.
- Scotiaptex nebulosa—Great gray owl.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Feeding on field mice, Bul. 31, p. 50; Ybk. 1905, p. 371; rabbits, Fauna 27, p. 369; shrews, Fauna 27, p. 370.
  - Formal report, Bul. 3, pp. 11, 157–158 (9 stomachs).
- Seiurus aurocapillus—Ovenbird.
  - Food at Marshall Hall, Bul. 17, pp. 20, 29, 34, 35, 103–104.
  - Food of nestlings, Ybk. 1900, p. 416.
- Seiurus motacilla—Louisiana water-thrush.
  - Food at Marshall Hall, Bul. 17, pp. 20, 38, 40, 103–104.

- Seiurus noveboracensis—Water-thrush.
  - Food at Marshall Hall, Bul. 17, pp. 20, 24, 34, 35, 38, 39, 103–104.
- Setophaga ruticilla—Redstart.
  - Brief account, Bul. 38, p. 83.
  - Food at Marshall Hall, Bul. 17, pp. 20, 23, 24, 29, 40, 103–104 (5 stomachs).
  - Food of nestlings, Ybk. 1900, p. 416.
- Shoveler, see Spatula clypeata.
- Shrike, Great gray, see Lanius excubitor.
  - Loggerhead, see Lanius ludovicianus.
  - Northern, see Lanius borealis.
- Sialia arctica, see Sialia currucoides.
- Sialia currucoides—Mountain bluebird.
  - Brief account, F. Bul. 54, p. 48.
  - Other notes, Bul. 30, p. 100.
- Sialia mexicana occidentalis—Western bluebird.
  - Brief account, F. Bul. 54 (rev.), p. 48 (92 stomachs).
  - Feeding on scale insects, Ybk. 1906, pp. 194, 198.
  - Food in California, Bul. 30, pp. 97–100 (187 stomachs).
- Sialia sialis—Bluebird.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, Bul. 38, p. 92; F. Bul. 54, p. 39 (205 stomachs); F. Bul. 54 (rev.), pp. 5, 46–48 (300 stomachs); Ybk. 1900, p. 413.
  - Distributing poison Rhus seeds, Rept. 1889, p. 368; Rept. 1890, p. 283.
  - Feeding on army worm, Bul. 1, p. 290; codling moth, Bul. 1, p. 320; cutworms, Bul. 1, p. 290; dogwood berries, Rept. 1890, p. 284; mahaleb cherries, Bul. 32, p. 65; mulberries, Bul. 32, p. 64; sourgum berries, Rept. 1890, p. 285.
  - Food at Marshall Hall, Bul. 17, pp. 32, 38, 43, 60, 62, **109–110** (7 stomachs).
  - Food of nestlings, Ybk. 1900, p. 413.
  - Insectivorous, Bul. 38, p. 9; Bul. 1, pp. 96, 126, 304.
  - Other notes, Bul. 1, pp. 94, 297.
  - Reference to studies of food habits, Ybk. 1899, pp. 263, 266.
- Siskin, Pine, see Spinus pinus.
- Sitta canadensis—Red-breasted nuthatch.
  - General nature of food, Bul. 30, p. 68.
  - Relation to orchards, Ybk. 1900, pp. 296–297.
- Sitta carolinensis—White-breasted nuthatch.
  - Brief account, Bul. 17, p. 107; Bul. 38, p. 88.
  - Feeding on scale insects, Ybk. 1906, pp. 194, 197.
  - General nature of food, Bul. 30, p. 68.
  - Relation to orchards, Ybk. 1900, pp. 296–297.
- Sitta pygmæa—Pygmy nuthatch.
  - Food in California, Bul. 30, pp. 67–68 (31 stomachs).
- Skylark, see Alauda arvensis.
- Snakebird, see Anhinga anhinga.
- Snipe, Wilson's, see Gallinago delicata.
- Snowbird, see Junco hyemalis.
- Solitaire, see Myadestes townsendi.
- Sora, see Porzana carolina.
- Sparrow, Chipping, see Spizella passerina.
  - English, see Passer domesticus.
  - Field, see Spizella pusilla.
  - Fox, see Passerella iliaca.
  - Golden-crowned, see Zonotrichia coronata.
  - Grasshopper, see Ammodramus savannarum australis.
  - Harris's, see Zonotrichia querula.
  - Henslow's, see Passerherbulus henslowi.
  - House, see Passer domesticus.
  - Ipswich, see Passerculus princeps.
  - Java, see Padda oryzivora.
  - Lark, see Chondestes grammacus.
  - Lincoln's, see Melospiza lincolni.
  - Nelson's, see Passerherbulus nelsoni.
  - Savanna, see Passerculus sandwichensis.
  - Seaside, see Passerherbulus maritimus.
  - Sharp-tailed, see Passerherbulus caudacutus.
  - Song, see Melospiza melodia.
  - Swamp, see Melospiza georgiana.
  - Spanish, see Passer hispaniolensis.
  - Tree [American], see Spizella monticola.
  - Tree [Old World], see Passer montanus.
  - Vesper, see Poœcetes gramineus.
  - White-crowned, see Zonotrichia leucophrys.
  - White-throated, see Zonotrichia albicollis.
- Spatula clypeata—Shoveler.
  - Brief account, Bul. 38, p. 19.
  - Feeding on larvæ and pupæ of *Ephydra hians*, Fauna 7, p. 17.
  - Vegetable food, Circ. 81, p. 1.
- Speotyto cunicularia floridana—Florida burrowing owl.
  - Food of adults and nestlings, Ybk. 1900, p. 431.
- Speotyto cunicularia hypogæa—Burrowing owl.
  - Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Brief account, Bul. 31, p. 50; Circ. 61, pp. 3, 12, 13; Ybk. 1894, pp. 217, 225, 227.
  - Feeding on beetles, Bul. 4, p. 15; grasshoppers, Bul. 4, p. 15; Fauna 7, p. 44; horned larks, Bul. 2, p. 124; Bul. 23, p. 12; insects, Fauna 5, p. 97; Rept. 1889, p. 373; mice, Bul. 2, p. 124; pocket mice (*Perognathus hispidus paradoxus*), Fauna

- Speotyto cunicularia hypogæa—Continued.
  - 25, p. 137; scorpions, Fauna 5, p. 97; spermophiles, Bul. 4, pp. 15–16.
  - Formal report, Bul. 3, pp. 11, 14, 165, **189–196** (32 stomachs); Rept. 1887, p. 422 (10 stomachs).
- Sphyrapicus ruber—Red-breasted sapsucker.
  - Brief account, Bul. 39, pp. 95–96.
  - Food in California, Bul. 34, pp. **21–22**, 29 (24 stomachs).
  - Formal report, Bul. 37, pp. 10, 11, **31–32** (34 stomachs).
  - Other notes, Bul. 34, p. 8.
  - Relation to trees, Bul. 39, pp. 16–21, **50–53**, 54–62, 86, 98–99.
- Sphyrapicus thyroideus—Williamson's sapsucker.
  - Brief account, Bul. 39, pp. 95–96.
  - Formal report, Bul. 37, pp. 10, 11, **32–33** (17 stomachs).
  - Relation to trees, Bul. 39, pp. 9, 16–21, **53**, 54–62, 66, 98–99.
- Sphyrapicus varius—Yellow-bellied sapsucker.
  - Brief account, Bul. 38, p. 47; Bul. 39, pp. 95–96; F. Bul. 54, pp. 9, 10; F. Bul. 54 (rev.), pp. 12–13; Ybk. 1900, pp. 294–295.
  - Feeding on fruits of cherry, flowering dogwood, grape, and sour gum, Rept. 1890, p. 284; scale insects, Ybk. 1906, p. 197.
  - Food at Marshall Hall, Bul. 17, pp. 19, 33, 62, **88–90**, 110.
  - Food of nestlings, Ybk. 1900, pp. 427–428.
  - Formal report, Bul. 7, pp. 7, 8, 10, 11, **28–31**, 38–39 (81 stomachs); Bul. 37, pp. 10, 11, **27–31**, 42, (313 stomachs).
  - Injurious, Bul. 34, p. 21; Ybk. 1907, p. 168.
  - Reference to studies of food habits, Ybk. 1899, p. 266.
  - Relation to orchards, Ybk. 1900, pp. 294–295.
  - Relation to trees, Bul. 38, p. 47; Bul. 39, pp. 16–21, **21–50**, 54–91, 92–95, 98–99.
- Spinus pinus—Pine siskin.
  - Feeding on weed seeds, Fauna 7, p. 85; Ybk. 1898, pp. 222, 229.
- Spiza americana—Dickcissel.
  - Brief account, Bul. 38, p. 69; Ybk. 1900, p. 420.
  - Feeding on boll weevil, Bul. 22, p. 16; Bul. 25, pp. 9, 12, 18, 21; Bul. 29, pp. 6, 19, 30; Circ. 64, p. 5; weed seeds, Ybk. 1898, pp. 226, 227, 228, 229.
  - Food of nestlings, Ybk. 1900, p. 420.
  - Formal report, Bul. 15, pp. 23, 24, 28, 45, **89–92** (152 stomachs).
- Spizella monticola—Tree sparrow.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, F. Bul. 54, p. 28; F. Bul. 54 (rev.), p. 32.
  - Feeding on seeds, Bul. 9, pp. 17, 20; of grapes, Fauna 3, p. 96; of weeds, Fauna 3, p. 96; Ybk. 1898, pp. 222, 225, 226, 227; Ybk. 1907, p. 172.
  - Food at Marshall Hall, Bul. 17, pp. 16, 71, 74–75 (9 stomachs).
  - Formal report, Bul. 15, pp. 18, 25, 27, 37, 38, 39, 42, **75–76** (517 stomachs).
- Spizella passerina—Chipping sparrow.
  - Beneficial, Bul. 38, p. 9; Ybk. 1897, p. 670.
  - Brief account, Bul. 38, p. 65; F. Bul. 54, pp. 26–27; F. Bul. 54 (rev.), pp. 31–32.
  - Feeding on cankerworms, Bul. 1, p. 263; mulberries, Rept. 1890, p. 285; scale insects, Ybk. 1906, p. 194; weed seeds, Ybk. 1898, pp. 222, 223, 224, 225, 226, 227, 228.
  - Food at Marshall Hall, Bul. 17, pp. 15–16, 22, 25, 26, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 40, 43, 70, 71, **72–73**, 97, 110 (61 stomachs).
  - Food in California, Bul. 34, pp. **80–82**, 84 (96 stomachs).
  - Food of nestlings, Ybk. 1900, pp. 419–420.
  - Formal report, Bul. 15, pp. 15, 17, 18, 21, 23, 24, 26, 27, 28, 30, 32, 33, **76–78** (250 stomachs).
  - Other notes, Bul. 1, p. 93; Fauna 7, p. 119.
  - Reference to studies of food habits, Ybk. 1899, p. 264.
- Spizella pusilla—Field sparrow.
  - Brief account, F. Bul. 54, pp. **26–27**, 28; F. Bul. 54 (rev.), pp. 31–32.
  - Feeding on boll weevil, Bul. 29, pp. 6, 20, 28, 30; Circ. 64, pp. 3, 5; weed seeds, Ybk. 1898, pp. 222, 223, 225, 226, 228.
  - Food at Marshall Hall, Bul. 17, pp. 15–16, 24, 26, 27, 30, 32, 34, 35, 40, 41, 60, 70, 71, 72, 73, 74, 97 (31 stomachs).
  - Formal report, Bul. 15, pp. 15, 18, 21, 23, 24, 25, 26, 27, 28, 30, 33, 37, 39, 42, **78–80** (175 stomachs).
- Spizella socialis, see Spizella passerina.
- Squatarola squatarola—Black-bellied plover.
  - Feeding on crowberries (*Empetrum*), Fauna 27, p. 332; grasshoppers, Circ. 79, p. 2.
- Starling, see Sturnus vulgaris.
- Steganopus tricolor—Wilson's phalarope.
  - Feeding on billbugs, Circ. 79, p. 6; crane flies, Circ. 79, p. 4; Dytiscidæ, Circ. 79, p. 8; mosquitoes, Circ. 79, p. 2.

Stelgidopteryx serripennis—Rough-winged swallow.
- Food at Marshall Hall, Bul. 17, pp. 20, 24, 33, 34, 35, 39, 98–99 (7 stomachs).
- Protection urged, Circ. 57, p. 2.

Stercorarius parasiticus—Parasitic jaeger.
- Feeding on beetles, dragon fly, fish, insects, and young tern, Fauna 27, p. 261.

Stercorarius pomarinus—Pomarine jaeger.
- Pursuing gulls and terns to rob them of their prey, Fauna 22, p. 78.

Sterna fuliginosa, see Sterna fuscata.

Sterna fuscata—Sooty tern.
- Fishing habits described, Fauna 14, p. 25.
- Food of nestlings, Ybk. 1900, p. 434.

Sterna maxima—Royal tern.
- Food of nestlings, Ybk. 1900, p. 434.

Sterna paradisæa—Arctic tern.
- Food of nestlings, Ybk. 1900, p. 434.

Stilt, Black-necked, see Himantopus mexicanus.
- Knudsen's, see Himantopus knudseni.

Stork, Maguari, see Euxenura maguari.
- White, see Ciconia ciconia.

Strix aluco, see Aluco flammeus.

Strix occidentalis—Spotted owl.
- Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
- Brief account, Bul. 3, pp. 11, 156–157.

Strix pratincola, see Aluco pratincola.

Strix varia—Barred owl.
- Beneficial, Ybk. 1895, p. 590; Ybk. 1896, p. 628; Ybk. 1897, p. 670.
- Brief account, Bul. 31, pp. 48–49; Bul. 38, p. 42; Circ. 61, pp. 3, 11–12 (109 stomachs); Ybk. 1894, pp. 217, 225; Ybk. 1900, p. 430.
- Feeding on Brewer's blackbird, cardinal, Bul. 2, p. 121; cotton rat (*Sigmodon hispidus texianus*), Fauna 25, p. 116; field mice, Bul. 31, pp. 48–49; Ybk. 1905, p. 371; Leconte's sparrow, Bul. 2, p. 121; rabbits, Ybk. 1907, p. 336; ruffed grouse, Bul. 24, p. 28.
- Food of nestlings, Ybk. 1900, p. 430.
- Formal report, Bul. 3, pp. 11, 14, 135, 146, 150–156 (109 stomachs); Rept. 1887, p. 419 (41 stomachs).

Sturnella magna—Meadowlark.
- Beneficial, Rept. 1890, p. 280; Ybk. 1897, p. 670.
- Bounty laws, Ybk. 1896, p. 57.
- Brief account, Bul. 12, pp. 20–21; Bul. 12 (rev.), pp. 27–28; F. Bul. 54, pp. 21–23 (238 stomachs), F. Bul. 26–27 (285 stomachs); Rept. 1890, p. 280 (30 stomachs).
- Exempt from protection in Georgia, Bul. 12 (rev.), p. 27.

Sturnella magna—Continued.
- Feeding on boll weevil, Bul. 22, pp. 10, 16; Bul. 25, pp. 8, 9, 11, 21; Bul. 29, pp. 6, 9, 18, 27–28, 29, 30; Circ. 57, p. 4; Circ. 64, pp. 2, 3, 5; weed seeds, Bul. 15, pp. 37, 38–39; Ybk. 1898, pp. 222, 230–231.
- Food at Marshall Hall, Bul. 17, pp. 12, 14, 22, 28, 30, 32, 34, 35, 37–38, 40, 70, 71, 77, 94–95, 110, 111 (7 stomachs).
- Formal report, Ybk. 1895, pp. 419, 420–426 (238 stomachs).
- Other notes, Ybk. 1904, p. 514; Ybk. 1908, p. 346.
- Reference to studies of food habits, Ybk. 1899, p. 266.
- Relation to clover seed, Rept. 1890, p. 280.

Sturnella magna neglecta, see Sturnella neglecta.

Sturnella neglecta—Western meadowlark.
- Feeding on boll weevil, Bul. 22, pp. 9, 16; Bul. 25, pp. 8, 9, 11, 21; Bul. 29, pp. 6, 9, 18, 27–28, 30; Circ. 64, p. 5.
- Food in California, Bul. 34, pp. 65–68 (91 stomachs).
- Killed by eating poisoned grain, Bul. 23, p. 13; Circ. 76, p. 13; F. Bul. 352, p. 8; Ybk. 1908, p. 308.
- Pulling wheat, Bul. 23, p. 15.

Sturnus vulgaris—Starling.
- Admission denied, F. Bul. 470, p. 30; Rept. 1900, p. 41; Rept. 1904, p. 296; Rept. 1907, p. 493; Ybk. 1905, p. 545.
- Admission to Western Australia prohibited, Rept. 1899, p. 68; Ybk. 1898, p. 109.
- Driving other birds away, Bul. 1, p. 333.
- Economic status, introduction dangerous, etc., Rept. 1899, p. 68; Rept. 1907, p. 493; Ybk. 1898, pp. 90, 101–103, 107, 109, 110.
- Injurious, Circ. 34, p. 7; Circ. 80, p. 24; F. Bul. 160, p. 48; F. Bul. 180, p. 42; F. Bul. 470, p. 30; Rept. 1908, p. 587.
- Injurious in Australasia, Rept. 1899, p. 68; Ybk. 1898, p. 109.
- Other notes, Rept. 1899, p. 68; Rept. 1907, p. 493.
- Repressive measures, Rept. 1908, p. 587.

Sula nebouxi—Blue-footed booby.
- Feeding on fish, Fauna 14, pp. 23, 25, 32.

Surnia ulula caparoch—Hawk owl.
- Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
- Brief account, Bul. 3, pp. 187–189; Rept. 1887, p. 422.

- Surnia ulula caparoch—Continued.
  - Feeding on field mice, Bul. 31, p. 50; Ybk. 1905, p. 371; (*Microtus drummondi*) Fauna 27, p. 377; redpolls, ruffed grouse, Fauna 27, p. 377; spermophiles, Bul. 4, pp. 15–16; varying hare, Fauna 27, p. 376.
- Swallow, Bank, see Riparia riparia.
  - Barn, see Hirundo erythrogastra.
  - Cliff, see Petrochelidon lunifrons.
  - European, see Hirundo rustica.
  - Northern violet-green, see Tachycineta thalassina lepida.
  - Rough-winged, see Stelgidopteryx serripennis.
  - Tree, see Iridoprocne bicolor.
- Swan, Whistling, see Olor columbianus.
- Swift, Chimney, see Chætura pelagica.
- Syrnium nebulosum, see Strix varia.
- Syrnium occidentale, see Strix occidentalis.
- Syrnium varium, see Strix varia.

T.

- Tachycineta bicolor, see Iridoprocne bicolor.
- Tachycineta thalassina lepida—Northern violet-green swallow.
  - Food in California, Bul. 30, pp. 32–33 (74 stomachs).
  - Other notes, F. Bul. 54 (rev.), pp. 37–38.
- Tanager, Scarlet, see Piranga erythromelas.
  - Summer, see Piranga rubra.
  - Tres Marias, see Piranga bidentata flammea.
  - Western, see Piranga ludoviciana.
- Tantalus loculator, see Mycteria americana.
- Teal, Blue-winged, see Querquedula discors.
  - Green-winged, see Nettion carolinense.
- Telmatodytes palustris—Long-billed marsh wren.
  - Food at Marshall Hall, Bul. 17, pp. 20, 33, 34, 35, 38, 40, 43, **107** (5 stomachs).
  - Food in California, Bul. 30, pp. 62–64 (53 stomachs).
  - Food of nestlings, Ybk. 1900, p. 436.
- Tern, Arctic, see Sterna paradisæa.
  - Black, see Hydrochelidon nigra surinamensis.
  - Royal, see Sterna maxima.
  - Sooty, see Sterna fuscata.
- Tetrao urogallus—Capercaillie.
  - Feeding on birches and conifers, F. Bul. 197, p. 15.
- Thrasher, Brown, see Toxostoma rufum.
  - California, see Toxostoma redivivum.
  - Leconte's, see Toxostoma lecontei.
  - Sage, see Oreoscoptes montanus.
- Thrush, Gray-cheeked, see Hylocichla aliciæ.
  - Hermit, see Hylocichla guttata.
- Thrush, Olive-backed, see Hylocichla ustulata.
  - Russet-backed, see Hylocichla ustulata.
  - Song, see Turdus iliacus.
  - Varied, see Ixoreus nævius.
  - Wood, see Hylocichla mustelina.
- Thryomanes bewicki—Bewick's wren.
  - Feeding on boll weevil, Circ. 64, pp. 4, 5; scale insects, Ybk. 1906, p. 194.
  - Food in California, Bul. 30, pp. 57–60 (146 stomachs).
- Thryothorus ludovicianus—Carolina wren.
  - Brief account, Bul. 38, p. 86.
  - Feeding on boll weevil, Bul. 22, pp. 8, 16; Bul. 25, pp. 9, 14, 21; Bul. 29, pp. 6, 21–22, 29, 30; Bul. 38, p. 86; Circ. 64, pp. 4, 5.
  - Food at Marshall Hall, Bul. 17, pp. 30, 32, **107**.
- Titmouse, Black-crested, see Bæolophus atricristatus.
  - Blue, see Cyanistes cæruleus.
  - Bridled, see Bæolophus wollweberi.
  - Great, see Parus major.
  - Long-tailed, see Ægithalos caudatus.
  - Marsh, see Pœcile palustris.
  - Plain, see Bæolophus inornatus.
  - Tufted, see Bæolophus bicolor.
- Totanus flavipes—Yellowlegs.
  - Feeding on grasshoppers, Circ. 79, p. 4.
- Towhee, see Pipilo erythrophthalmus.
  - California, see Pipilo crissalis.
  - Green-tailed, see Oreospiza chlorura.
  - Spotted, see Pipilo maculatus subspecies.
  - Spurred, see Pipilo maculatus megalonyx.
- Toxostoma lecontei—Leconte's thrasher.
  - Food in captivity, Fauna 7, p. 129.
- Toxostoma redivivum—California thrasher.
  - Food in California, Bul. 30, pp. 55–56 (82 stomachs).
- Toxostoma rufum—Brown thrasher.
  - Brief account, Bul. 38, p. 86; F. Bul. 54, pp. 34–35 (121 stomachs); F. Bul. 54 (rev.), pp. 40–41 (121 stomachs); Ybk. 1900, p. 415.
  - Feeding on boll weevil, Bul. 22, pp. 11, 16; Bul. 25, pp. 9, 14, 15, 21; Bul. 29, pp. 6, 23, 30; Circ. 64, p. 5; mahaleb cherries, Bul. 32, p. 65.
  - Food at Marshall Hall, Bul. 17, pp. 32, 38, 56, 60, **105–106**.
  - Food of nestlings, Ybk. 1900, p. 415.
  - Formal report, Ybk. 1895, pp. 405, 406, **411–415**, 418 (121 stomachs).
  - Other notes, Bul. 30, p. 55.
  - Reference to studies of food habits, Ybk. 1899, p. 266.
  - Request for information on economic value, Ent. Circ. 20 [p. 2].

- Tringa canutus—Knot.
  - Feeding on crayfishes, Circ. 79, p. 6; Dytiscidæ, Circ. 79, p. 8; grasshoppers, Circ. 79, p. 4; *Nereis*, Circ. 79, p. 8.
- Trochilus colubris, see Archilochus colubris.
- Troglodytes aëdon—House wren.
  - Beneficial, Ybk. 1897, p. 670.
  - Brief account, F. Bul. 54, pp. 35–36 (52 stomachs); F. Bul. 54 (rev.), pp. 41–42 (52 stomachs); Ybk. 1900, p. 413.
  - Food at Marshall Hall, Bul. 17, pp. 24, 25, 26, 30, 32, 33, 34, 35, 38, 45–46, 49, 106–107, 110 (20 stomachs).
  - Food in California, Bul. 30, pp. 60–62 (36 stomachs).
  - Food of nestlings, Ybk. 1900, pp. 413–415; Ybk. 1902, p. 216.
  - Formal report, Ybk. 1895, pp. 405, 406, 416–418 (52 stomachs).
  - Other notes, Bul. 1, pp. 96, 275; Ybk. 1904, p. 514.
  - Reference to studies of food habits, Ybk. 1899, p. 266.
- Trogon ambiguus goldmani—Goldman's trogon.
  - Feeding on wild fig, Fauna 14, p. 61.
- Tryngites subruficollis—Buff-breasted sandpiper.
  - Feeding on grasshoppers, Circ. 79, p. 2.
- Turdus iliacus—Song thrush.
  - Admission denied, Rept. 1908, p. 581.
  - Admission to Western Australia prohibited, Rept. 1899, p. 68; Ybk. 1898, p. 109.
  - Injurious in Australasia, Rept. 1899, p. 68; Ybk. 1898, p. 109.
- Turdus merula—Blackbird.
  - Admission to West Australia prohibited, Rept. 1899, p. 68; Ybk. 1898, p. 109.
  - Economic status, introduction dangerous, etc., Ybk. 1898, pp. 90, 106, 107, 109; Ybk. 1909, p. 257.
  - Injurious in Australasia, Rept. 1899, p. 68; Ybk. 1898, p. 109, in New Zealand, Ybk. 1909, p. 257.
- Turdus musicus, see Turdus iliacus.
- Turkey, Merriam's, see Meleagris gallopavo merriami.
  - Wild, see Meleagris gallopavo silvestris.
- Turnstone, see Arenaria interpres.
- Tympanuchus americanus—Prairie chicken.
  - Brief account, Ybk. 1900, p. 432.
  - Feeding on potato beetle, Bul. 32, p. 47; weed seeds, Ybk. 1898, p. 231.
  - Food of nestlings, Ybk. 1900, p. 432.
  - Formal report, Bul. 24, pp. 10–18, 23 (71 stomachs).
- Tympanuchus cupido—Heath hen.
  - Brief account, Bul. 24, pp. 18–19.
- Tympanuchus pallidicinctus—Lesser prairie chicken.
  - Brief account, Bul. 24, pp. 19–20.
- Tyrannus tyrannus—Kingbird.
  - Brief account, Bul. 38, p. 53; F. Bul. 54, pp. 11–12 (281 stomachs); F. Bul. 54 (rev.), pp. 14–15 (420 stomachs); Ybk. 1900, p. 426.
  - Feeding on bees, Bul. 34, pp. 32–33; Rept. 1899, p. 69; boll weevil, Bul. 29, pp. 6, 14, 15, 24, 29, 30; Circ. 64, p. 5; cherries, Rept. 1890, p. 282; mahaleb cherries, Bul. 32, p. 65; mulberries, Rept. 1890, p. 285; robber flies, Rept. 1899, p. 69; rose beetles, Bul. 32, p. 20.
  - Food at Marshall Hall, Bul. 17, pp. 17, 22, 23, 24, 26, 30, 31–32, 33, 34, 36, 37, 38, 39, 40, 56, 59, 60, 61, 91–92 (16 stomachs).
  - Food of nestlings, Ybk. 1900, p. 426.
  - Formal report, Rept. 1893, pp. 233–234 (171 stomachs).
  - Other notes, Ybk. 1904, p. 514.
  - Reference to studies of food habits, Ybk. 1899, p. 266.
  - Relation to bees, Bul. 34, pp. 32–33; Rept. 1899, p. 69.
- Tyrannus verticalis—Arkansas kingbird.
  - Brief account, F. Bul. 54 (rev.), pp. 15–16 (62 stomachs).
  - Food in California, Bul. 34, pp. 32–34 (78 stomachs).
- Tyrannus vociferans—Cassin's kingbird.
  - Brief notes on food, Bul. 34, p. 34; F. Bul. 54 (rev.), p. 16.

U.

- Uria lomvia arra—Pallas's murre.
  - Food of nestlings, Ybk. 1900, p. 433.
- Urinator arcticus, see Gavia arctica.
- Uroloncha acuticauda—Japanese nun.
  - Admission to Hawaii denied, Rept. 1909, p. 542.
- Urubutinga anthracina — Mexican black hawk.
  - Beneficial, Circ. 61, p. 3; Ybk. 1894, p. 217; Ybk. 1895, p. 590; Ybk. 1896, p. 628.
  - Formal report, Bul. 3, pp. 11, 84–85 (6 stomachs).

V.

- Veery, see Hylocichla fuscescens.
- Vermivora celata lutescens — Lutescent warbler.
  - Feeding on scale insects, Ybk. 1906, p. 194.
  - Food in California, Bul. 30, pp. 48, 51 (65 stomachs).
- Vireo belli pusillus—Least vireo.
  - Feeding on scale insects, Ybk. 1906, p. 194.
- Vireo, Cassin's, see Lanivireo solitarius cassini.
- Vireo flavifrons, see Lanivireo flavifrons.
- Vireo gilvus, see Vireosylva gilva.

- Vireo griseus—White-eyed vireo.
  - Feeding on scale insects, Ybk. 1906, p. 195.
  - Food at Marshall Hall, Bul. 17, pp. 20, 23, 26, 29, 34, 35, 40, 59, 60, 61, 102 (10 stomachs).
- Vireo huttoni—Hutton's vireo.
  - Feeding on scale insects, Ybk. 1906, p. 194.
  - Food in California, Bul. 30, pp. 41–42 (54 stomachs).
- Vireo, Hutton's, see Vireo huttoni.
- Vireo, Least, see Vireo belli pusillus.
- Vireo olivaceus, see Vireosylva olivacea.
- Vireo, Red-eyed, see Vireosylva olivacea.
- Vireo solitarius cassini, see Lanivireo solitarius cassini.
- Vireo, Warbling, see Vireosylva gilva.
- Vireo, White-eyed, see Vireo griseus.
- Vireo, Yellow-throated, see Lanivireo flavifrons.
- Vireosylva gilva—Warbling vireo.
  - Feeding on mulberries, Rept. 1890, p. 285; scale insects, Ybk. 1906, p. 194.
  - Food at Marshall Hall, Bul. 17, pp. 30, 35, 40, 102.
  - Food in California, Bul. 30, pp. 39–40 (110 stomachs).
- Vireosylva olivacea—Red-eyed vireo.
  - Brief account, Bul. 38, p. 73.
  - Feeding on mulberries, Rept. 1890, p. 285; scale insects, Ybk. 1906, p. 195.
  - Food at Marshall Hall, Bul. 17, pp. 20, 23, 24, 29, 30, 34, 35, 39, 40, 43, 56, 59, 60, 61, 102 (13 stomachs).
  - Food of nestlings, Ybk. 1900, p. 416.
- Vulture, Black, see Catharista urubu.
  - California, see Gymnogyps californianus.
  - Turkey, see Cathartes aura septentrionalis.

W.

- Warbler, Audubon's, see Dendroica auduboni.
  - Bay-breasted, see Dendroica castanea.
  - Black-and-white, see Mniotilta varia.
  - Black-poll, see Dendroica striata.
  - Black-throated blue, see Dendroica cærulescens.
  - Black-throated green, see Dendroica virens.
  - Canadian, see Wilsonia canadensis.
  - Cape May, see Dendroica tigrina.
  - Lutescent, see Vermivora celata lutescens.
  - Magnolia, see Dendroica magnolia.
  - Myrtle, see Dendroica coronata.
  - Palm, see Dendroica palmarum.
  - Parula, see Compsothlypis americana.
  - Pine, see Dendroica vigorsi.
- Warbler, Prairie, see Dendroica discolor.
  - Prothonotary, see Protonotaria citrea.
  - Townsend's, see Dendroica townsendi.
  - Wilson's, see Wilsonia pusilla.
  - Worm-eating, see Helmitheros vermivorus.
  - Yellow, see Dendroica æstiva.
- Water-thrush, see Seiurus noveboracensis.
  - Louisiana, see Seiurus motacilla.
- Water-turkey, see Anhinga anhinga.
- Waxwing, Bohemian, see Bombycilla garrula.
  - Cedar, see Bombycilla cedrorum.
- Weaver bird, Madagascar, see Foudia madagascariensis.
- Whippoorwill, see Antrostomus vociferus.
- White-eye, South African, see Zosterops capensis.
- Widgeon, see Mareca americana.
- Wilsonia canadensis—Canadian warbler.
  - Feeding on scale insects, Ybk. 1906, p. 195.
  - Food at Marshall Hall, Bul. 17, pp. 20, 29, 34, 39, 103–104.
- Wilsonia pusilla—Wilson's warbler.
  - Feeding on scale insects, Ybk. 1906, p. 194.
  - Food at Marshall Hall, Bul. 17, pp. 20, 24, 103–104.
  - Food in California, Bul. 30, pp. 51–52 (52 stomachs).
- Woodcock, see Philohela minor.
- Woodpecker, Arctic three-toed, see Picoides arcticus.
  - Arizona, see Dryobates arizonæ.
  - California, see Melanerpes formicivorus bairdi.
  - Downy, see Dryobates pubescens.
  - Gila, see Centurus uropygialis.
  - Golden-fronted, see Centurus aurifrons.
  - Grayson's, see Dryobates scalaris graysoni.
  - Hairy, see Dryobates villosus.
  - Ivory-billed, see Campephilus principalis.
  - Lewis's, see Asyndesmus lewisi.
  - Nuttall's, see Dryobates nuttalli.
  - Pileated, see Phlœotomus pileatus.
  - Red-bellied, see Centurus carolinus.
  - Red-cockaded, see Dryobates borealis.
  - Red-headed, see Melanerpes erythrocephalus.
  - San Lucas, see Dryobates scalaris lucasanus.
  - Texas, see Dryobates scalaris bairdi.

Woodpecker, Three-toed, see Picoides americanus.
White-headed, see Xenopicus albolarvatus.
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Wren, Bewick's, see Thryomanes bewicki.
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Carolina, see Thryothorus ludovicianus.
Dotted cañon, see Catherpes mexicanus punctulatus.
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Long-billed marsh, see Telmatodytes palustris.
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Winter, see Nannus hiemalis.
Wren tit, see Chamæa fasciata.

X.

Xanthocephalus xanthocephalus—Yellow-headed blackbird.
Brief account, Ybk. 1897, pp. 345, 351, 353.
Damage to corn, Ybk. 1894, p. 237; grain, Rept. 1887, pp. 428, 429, 430, 454, 455, 456; Ybk. 1897, pp. 345, 351, 353; Ybk. 1898, p. 230.
Feeding on weed seeds, Ybk. 1898, p. 230.
Formal report, Bul. 13, pp. 9, 11, 30–38 (138 stomachs).
Other notes, Rept. 1887, pp. 428, 429, 430.
Xenopicus albolarvatus — White - headed woodpecker.
Brief account, Bul. 37, p. 63.

Y.

Yellow-hammer [of Europe], see Emberiza citrinella.
Yellowlegs, see Totanus flavipes.
Yellowthroat, see Geothlypis trichas.

Z.

Zamelodia ludoviciana—Rose-breasted grosbeak.
Beneficial, Ybk. 1897, p. 670.
Brief account, F. Bul. 54, pp. 28–30; F. Bul. 54 (rev.), pp. 34–35; F. Bul. 456, pp. 7–9, 12, 13.
Feeding on potato beetle, Bul. 17, p. 25; Bul. 34, p. 93; Rept. 1888, pp. 535–536; Rept. 1889. p. 369; Rept. 1905, pp. 306, 314; Rept. 1906, p. 415; Ybk. 1907, pp. 173, 175; scale insects, Ybk. 1906, pp. 192, 195; weed seeds, Ybk. 1898, p. 230.
Food of nestlings, Ybk. 1900, p. 418.
Formal report, Bul. 32, pp. 38–59, 71, 91 (176 stomachs).
Zamelodia ludoviciana—Continued.
Other notes, Bul. 1, p. 323; Fauna 27, p. 449.
Reference to studies of food habits, Ybk. 1899, p. 266.
Zamelodia melanocephala — Black - headed grosbeak.
Brief account, F. Bul. 54 (rev.), pp. 35–36 (70 stomachs); F. Bul. 456, pp. 9–10, 12, 13.
Feeding on black olive scale, Rept. 1905, p. 306; cherries, Bul. 34, p. 55; codling moth, Rept. 1904, p. 293; scale insects, Ybk. 1906, pp. 192, 194.
Food in California, Bul. 34, pp. 93–96 (225 stomachs).
Formal report, Bul. 32, pp. 60–77, 91 (226 stomachs).
Relation to fruit in California, Bul. 30, p. 13; Ybk. 1904, pp. 246, 248, 251.
Zenaidura macroura carolinensis—Mourning dove.
Brief account, Bul. 38, p. 36; F. Bul. 54 (rev.), pp. 6–7 (237 stomachs); Ybk. 1900, p. 431.
Damage to grain, Ybk. 1897, p. 352; Ybk. 1898, pp. 231–232.
Feeding on seeds of bunch grass (*Oryzopsis cuspidata*). Fauna 7, p. 32; Hungarian grass (*Setaria italica*), Rept. 1887, p. 429; weeds, Bul. 12, pp. 16–17; Bul. 12 (rev.), p. 24; Bul. 15, pp. 38–39; Ybk. 1898, pp. 222, 231–232.
Food at Marshall Hall, Bul. 17, pp. 13, 43, 69, 70, 71, 77–78, 85, 111.
Food of nestlings, Ybk. 1900, p. 431.
Killed by eating poisoned grain, Bul. 23, p. 13; Circ. 76, p. 13; Ybk. 1908, p. 308.
Other notes, Bul. 15, p. 74; Ybk. 1904, p. 514; Ybk. 1907, p. 170.
Zonotrichia albicollis—White-throated sparrow.
Brief account, Bul. 38, p. 64.
Feeding on boll weevil, Bul. 22, pp. 11, 16; Bul. 25, pp. 9, 12, 21; Bul. 29, pp. 6, 19–20, 30; Circ. 64, pp. 3, 5; waste oats, Fauna 33, p. 83; weed seeds, F. Bul. 54, p. 28; F. Bul. 54 (rev.), p. 32; Ybk. 1898, pp. 222, 224, 225, 226, 227.
Food at Marshall Hall, Bul. 17, pp. 16, 22, 30, 33, 34, 35, 38, 57, 71, 73, 75, 77 (17 stomachs).
Formal report, Bul. 15, pp. 15, 18, 26, 27, 28, 37, 39, 41, 42, 43, 45, 46, 72–75, 83, 90, (217 stomachs).
Zonotrichia coronata—Golden-crowned sparrow.
Feeding on weed seeds, Bul. 15, p. 27; Ybk. 1898, pp. 222, 225, 226.
Food in California, Bul. 34, pp. 78–79, 84 (184 stomachs).

Zonotrichia leucophrys — White-crowned sparrow.
  Feeding on scale insects, Ybk. 1906, p. 194; weed seeds, F. Bul. 54, p. 28; F. Bul. 54 (rev.), p. 32; Ybk. 1898, pp. 222, 225, 226, 227.
  Food in California, Bul. 34, pp. 75–77, 84, 85 (516 stomachs).
  Formal report, Bul. 15, pp. 21, 25, 27, 28, **69–72**, 74, 83, 90 (217 stomachs).
  Other notes, Fauna 7, p. 89.
Zonotrichia leucophrys—Continued.
  Relation to fruit in California, Ybk. 1904, p. 247.
Zonotrichia querula—Harris's sparrow.
  Feeding on weed seeds, Ybk. 1898, p. 226.
  Formal report, Bul. 15, pp. 27, 28, **68–69** (100 stomachs).
Zosterops capensis—South African white-eye.
  Feeding on scale insects, Ybk. 1906, p. 192.

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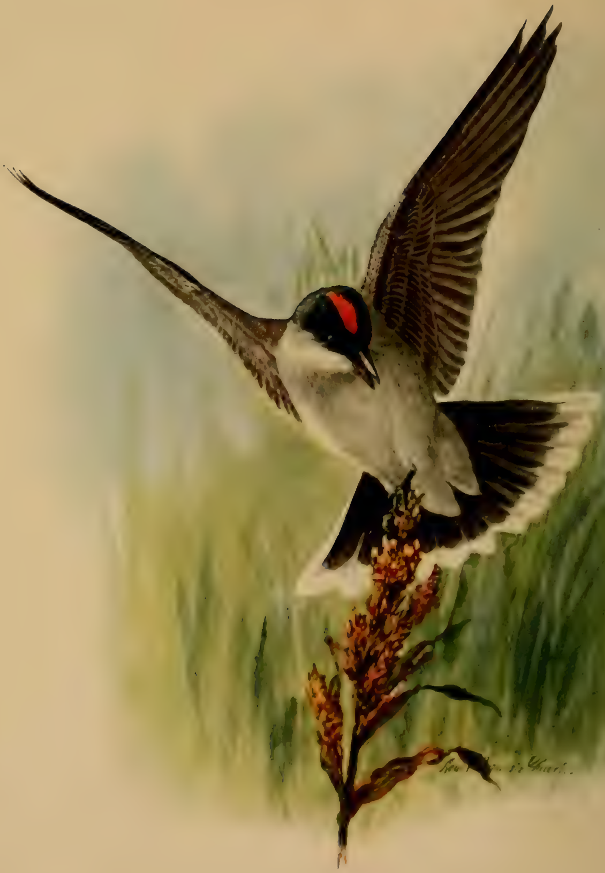
BIOLOGICAL SURVEY—BULLETIN No. 44
HENRY W. HENSHAW, *Chief*

FOOD OF OUR MORE IMPORTANT FLYCATCHERS

BY

F. E. L. BEAL
Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1912



KINGBIRD

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BY

F. E. L. BEAL
Assistant, Biological Survey

1862 1889

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., April 5, 1912.

Sir: I have the honor to transmit herewith, and to recommend for publication as Bulletin No. 44 of the Biological Survey, a report on the Food of Our More Important Flycatchers, by F. E. L. Beal. As more than 90 per cent of the food of the 17 species discussed in this paper consists of insects, their economic importance is at once apparent. Unfortunately some of the insects taken by flycatchers for food are parasitic and predaceous Hymenoptera, which are to be classed among useful insects. Impartial consideration of the diet of these flycatchers throughout the year, however, leads to the conviction that on the whole the birds do considerably more good than harm, and hence should be protected as allies of the farmer and the horticulturist.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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FOOD OF OUR MORE IMPORTANT FLYCATCHERS.

INTRODUCTION.

The flycatchers for the most part inhabit the open country, and prefer to live about gardens, orchards, and sparsely timbered hillsides. Several species are not averse to human neighbors and make their nests in the crannies of buildings, while a number of others build in covered sites, such as hollow trees, under bridges, or under the overhanging bank of a stream. Many of the species show a strong liking for the vicinity of water, and are frequently to be found in the neighborhood of streams or pools, and in dry parts of the country every watering trough by the roadside has its attendant flycatcher. This fondness for the vicinity of water doubtless arises from the fact that insects are abundant in such situations. Most of the species are migratory, though some of them within rather narrow limits.

These birds are extremely agile upon the wing, and turn in the air with extraordinary facility, which enables them to catch the flying insects, of which their food largely consists. Their favorite method of feeding is to perch upon a post, stake, or leafless twig, and from this outlook watch for their prey, and then to sally forth and snap the luckless insect in midair, often with a sharp click of the bill and a sudden turn back toward the perch.

One prominent characteristic, which is more or less marked in the whole family of flycatchers, is the pugnacity they display toward crows, hawks, or other large birds. This is especially shown when the intruders come about the nests of flycatchers, when they are attacked with the greatest vigor and driven off. This trait is particularly marked in kingbirds, so that if a pair of them nest in the vicinity of a poultry yard they serve as protectors of the poultry.

Within the limits of the United States there are 31 species of flycatchers; 1 is of accidental occurrence and 8 are of limited distribution and therefore of little economic importance. For the following discussion of the food of flycatchers 3,398 stomachs were examined, belonging to 17 species. Most of them were obtained in the United States, though a few were taken in British America. The animal food in the whole number of stomachs averages 94.99 per cent and the vegetable 5.01 per cent. In the following table the species are arranged in the order of the amount of their animal food. As some of the species are represented by a comparatively small number of stomachs, this arrangement can not be considered final.

TABLE I.—*Percentage of animal and vegetable food found in stomachs of flycatchers.*

Species.	Number of stomachs.	Animal food.	Vegetable food.
Olive-sided flycatcher (Nuttallornis borealis)	69	99.95	0.05
Western wood pewee (Myiochanes richardsoni)	174	99.93	.07
Say's phœbe (Sayornis sayus)	111	99.78	.22
Black phœbe (Sayornis nigricans)	344	99.41	.59
Western yellow-bellied flycatcher (Empidonax difficilis)	157	99.31	.69
Wood pewee (Myiochanes virens)	359	98.97	1.03
Least flycatcher (Empidonax minimus)	177	97.83	2.17
Acadian flycatcher (Empidonax virescens)	100	97.05	2.95
Yellow-bellied flycatcher (Empidonax flaviventris)	103	97.01	2.99
Scissor-tailed flycatcher (Muscivora forficata)	129	96.12	3.88
Alder flycatcher (Empidonax trailli alnorum)	135	96.05	3.95
Crested flycatcher (Myiarchus crinitus)	265	93.70	6.30
Ash-throated flycatcher (Myiarchus cinerascens)	91	92.32	7.68
Arkansas kingbird (Tyrannus verticalis)	109	90.61	9.39
Phœbe (Sayornis phœbe)	370	89.23	10.77
Kingbird (Tyrannus tyrannus)	665	88.93	11.07
Cassin's kingbird (Tyrannus vociferans)	40	78.57	21.43
Total or average	3,398	94.99	5.01

In the following table the species are arranged in their natural order, with the percentages of the principal elements of the food and the average of each kind in all the stomachs. It will be noted that Hymenoptera (wasps, bees, and ants) amount to nearly 35 per cent of the average diet of the 17 species, or more than one-third of their food. Of 13 of these species Hymenoptera are the largest element in the diet. Of 1 species Orthoptera (grasshoppers and crickets) are the leading food; in another Lepidoptera (moths and caterpillars) are the favorites, and in 2 others Diptera (flies) stand at the head. Hemiptera (bugs) are eaten quite extensively by some, but naturally the ones taken are the larger flying species. Plant lice and scales have not yet been found in the stomach of any flycatcher, though one bird was shot on a plant covered with lice, with which its bill was filled.

TABLE II.—*Detailed classification of food of flycatchers.*

Species.	Total animal food.	Total vegetable food.	Coleoptera (beetles).	Hymenoptera (wasps, bees, and ants).	Hemiptera (bugs).	Diptera (flies).	Orthoptera (grasshoppers and crickets).	Lepidoptera (moths and caterpillars).	Miscellaneous insects.	Arachnida (spiders and myriapods).	Fruit.	Miscellaneous vegetable food.
Scissor-tailed flycatcher	96.12	3.88	13.74	12.81	10.17	3.80	46.07	4.61	0.39	4.53	2.43	1.45
Kingbird	88.93	11.07	25.35	32.39	3.77	3.19	11.83	3.18	7.70	1.52	10.71	.36
Arkansas kingbird	90.61	9.39	17.02	31.38	5.36	.55	27.76	7.31	.99	.24	9.34	.05
Cassin's kingbird	78.57	21.43	14.91	21.61	3.41	2.91	14.67	18.21	2.51	.34	19.09	2.34
Crested flycatcher	93.70	6.30	16.78	13.69	14.26	3.06	15.62	21.38	4.88	4.03	5.36	.94
Ash-throated flycatcher	92.32	7.68	7.26	26.94	20.11	12.83	5.14	17.11	1.98	.95	7.64	.04
Phœbe	89.23	10.77	15.33	26.69	10.38	6.89	12.91	8.86	8.17	.00	4.99	5.78
Say's phœbe	99.78	.22	15.67	30.72	4.45	16.67	15.36	12.12	3.46	1.33	.06	.16
Black phœbe	99.41	.59	13.32	30.82	10.56	28.26	2.45	8.22	5.43	.35	.28	.31
Olive-sided flycatcher	99.95	.05	6.24	82.56	3.25	.88	1.12	4.13	1.77	.00	.04	.01
Wood pewee	98.97	1.03	14.23	28.20	5.99	29.98	3.44	12.31	2.61	2.21	.84	.19
Western wood pewee	99.93	.07	5.44	39.81	1.79	44.25	.00	5.17	3.23	.24	.05	.02
Yellow-bellied flycatcher	97.01	2.99	16.53	46.25	4.16	14.89	.00	5.68	.98	8.52	2.51	.48
Western yellow-bellied flycatcher	99.31	.69	8.39	38.76	8.44	31.22	.62	6.59	.71	4.58	.38	.31
Acadian flycatcher	97.05	2.95	13.76	39.93	6.03	8.15	6.38	18.87	.99	2.94	2.68	.27
Alder flycatcher	96.05	3.95	17.89	41.37	7.24	14.20	3.91	7.73	2.77	.94	3.88	.07
Least flycatcher	97.83	2.17	21.35	41.10	11.12	11.34	2.59	7.27	.95	2.11	1.83	.34
Average	**94.99**	**5.01**	**14.31**	**34.41**	**7.68**	**13.71**	**9.99**	**9.93**	**2.91**	**2.05**	**4.24**	**.77**

Farmers and horticulturists have never accused the flycatchers of doing any harm to their crops. The most that has been said against them is that certain of the larger species feed to a harmful extent upon honeybees. Stomach examinations, however, do not sustain this accusation. Honeybees do not form an important percentage of the food, and, moreover, a large proportion of those eaten are drones or males, of which, as is well known, there is in every hive a superfluity. The real harm, if any, done by this family of birds is in the destruction of predaceous and parasitic Hymenoptera. Of the former, however, so few are eaten that their loss is of no practical importance. Some parasitic Hymenoptera are taken by most flycatchers, and with certain of the smaller species they amount to a considerable percentage of the food. While theoretically this is harmful to the interests of husbandry, the precise amount of the damage is impossible of estimation. The parasites themselves often destroy useful insects, including other parasites, or are themselves destroyed by other insects, so that the question of the final result involves a problem so delicate and complicated as to preclude exact solution.

It is a well-known fact that Hymenoptera, aside from the parasitic species, are largely instrumental in the pollenization of plants, and many species are absolutely dependent upon insects for this service. So completely is this true that where cucumbers are raised under glass it is necessary to keep a hive of bees in each house or the crop will fail. In view of this fact the birds must be considered to render a very questionable service in destroying so many of these insects. On the other hand a single insect can pollinate a great many flowers, and as these insects are usually superabundant the harm done by their destruction is less than might at first be supposed. Moreover, this order of insect is not the only one that enjoys the distinction of serving as pollen bearers. Many beetles and flower-loving flies also transfer pollen from flower to flower and so help in this necessary work.

In considering the economic bearings of the food of the flycatchers one is impressed by the fact that it includes a large percentage of useful insects. The great order of Hymenoptera, which constitutes one-third of the average food of the flycatcher family, may fairly be classed as beneficial. The absolutely harmful species in this group are comparatively few, while the decidedly useful ones are many. As shown in the following pages, however, their food includes many insects other than Hymenoptera which are seriously destructive to crops, and it is believed that, weighing as impartially as possible the injuries done and the benefits conferred by them, their good qualities outweigh the bad and that the flycatchers herein discussed fairly earn the right to live unmolested.

SCISSOR-TAILED FLYCATCHER.

(*Muscivora forficata.*)

The scissor-tailed flycatcher is found in the United States, chiefly from central and eastern Texas and Oklahoma to southern Kansas, during the months from March to October; casually in western Louisiana, western Arkansas, and southwestern Missouri. In winter it moves farther south and with few exceptions retires beyond our southern boundary. Like the kingbird it prefers the open country to forests, and seems to be best suited with prairies or rolling country with scattered trees on which it can nest. In settled territory it takes kindly to orchards and even gardens in the near vicinity of buildings. While generally a quiet bird that lives on good terms with its neighbors, it displays something of the aggressive spirit of the kingbird in relation to crows and hawks, which it attacks with great vigor when they appear near its nest. The following description of some of the bird's habits is as good as has been written:

> One of his favorite performances is to fly up and, with rattling wings, execute an aerial seesaw, a line of sharp-angled VVVVVVV's, helping himself at the short turns by rapidly opening and shutting his long white scissors. As he goes up and down he utters all the while a penetrating scream *ka-quee′-ka-quee′-ka-quee′-ka-quee′-ka-quee′*, the emphasis being given each time at the top of the ascending line.
>
> Frequently when he is passing along with the even flight of a sober-minded crow and you are quietly admiring the salmon lining of his wings, he shoots rattling into the air, and as you stare after him drops back as suddenly as he rose. He does this apparently because the spirit moves him, as a boy slings a stone at the sky, but fervor is added by the appearance of a rival or an enemy, for he is much like a *Tyrannus* in his masterful way of controlling his landscape. He will attack caracaras and white-necked ravens, lighting on their backs and giving them vicious blows while screaming in their ears.[1]

The following discussion of this bird's food is based upon the contents of 129 stomachs taken in the months from April to October, inclusive. They are rather irregularly distributed, and only one was taken in the latter month. They were collected in the State of Texas except one from Florida, which is considerably outside of the bird's usual range. The animal food amounts to 96.12 per cent of the stomach contents, practically all of which was made up of insects and spiders. The vegetable food amounts to 3.88 per cent and is composed of small fruits and seeds.

Animal food.—Of the animal food beetles amount to 13.74 per cent and form a rather constant article of diet. Less than 1 per cent belong to theoretically useful families. The others are practically all of harmful species. *Diabrotica 12-punctata* was found in 1 stomach. This is the well-known 12-spotted cucumber beetle, which often does great injury to that plant, as well as to squash vines, corn, clover, beets, beans, peas, and asparagus. Snout beetles, or weevils, were found in a number of stomachs and 4 contained the well-known cotton-boll weevil (*Anthonomus grandis*), an insect which for the last 10 years has threatened the whole cotton industry of the South. The month of greatest beetle consumption is May, while June shows the least, but as only 2 stomachs were taken in that month the record is perhaps not reliable. Hymenoptera (bees and wasps) are eaten to the extent of 12.81 per cent, which is the lowest record but one for this item among the flycatchers. As a rule, Hymenoptera constitute one of the most important elements of the flycatcher's diet. As these insects, except the ants, are almost constantly on the wing during daylight, they are peculiarly adapted to the flycatcher's method of feeding. Those eaten by the scissortail are mostly of the larger kinds, i. e., bees and wasps, with very few of the smaller parasitic species.

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[1] Bailey, Florence Merriam, Handbook of Birds of the Western United States, p. 247, 1902.

Hemiptera (bugs) amount to 10.17 per cent of the diet and were found in 47 stomachs. At least 9 families were identified, but Pentatomidæ (stinkbugs) were the most abundant and were found in 22 of the 47 stomachs. In 2 stomachs was identified that disagreeable pest the squash bug (*Anasa tristis*). This creature is not classified by entomologists in the stinkbug family, but as far as disgusting odor is concerned it is well qualified for that honor. As is well known, it is a great pest upon squash vines and other cucurbitaceous plants. Most of the other bugs identified are harmful. Diptera (flies) do not seem to appeal to this flycatcher as articles of food. They were found in the stomachs taken in April, May, and September only, and amount to but 3.80 per cent. Diptera occurred in only 14 stomachs, in 8 of which they were identified as robber flies (Asilidæ), an insect which will be more fully discussed in relation to the kingbird.

Orthoptera (grasshoppers and crickets) are evidently the favorite food of the scissortail. They were found in the stomachs of every month, with a good percentage in all except April. The average for the year is 46.07 per cent—the highest for any flycatcher. The 1 stomach taken in October contained 86 per cent of these insects, but it is probable that the month of maximum consumption is July, when they amount to over 65 per cent. As this bird is said to seldom light upon the ground, it follows that these insects must be captured when they take their short flight or jumps. *Melanoplus femur-rubrum* was identified in 1 stomach and was probably contained in many more but too badly broken for recognition. This is the well-known red-legged grasshopper that often does great harm to grass and grain crops. In general grasshoppers and crickets are eaten to the greatest extent by the ground-feeding birds, such as the meadowlark, while the flycatchers take the flying Hymenoptera. In this case the rule seems to be reversed. Of the 129 stomachs 88 contained grasshoppers or crickets and 8 held no other food. Caterpillars, with a few moths, constitute a small but rather regular article of diet with the scissortail. They amount to 4.61 per cent for the year and were found in the stomachs of every month except October. In several stomachs the cotton leaf worm (*Alabama argillacea*) was identified and the cotton bollworm (*Heliothis obsoleta*) in another. Both of these are well-known pests of the cotton plant and also feed upon a number of other cultivated plants. The latter is also well known as the corn worm, because it feeds upon the sweet corn of the garden. It also preys upon tomatoes and occasionally upon beans and peas. A few dragon flies and some other miscellaneous insects and spiders make the rest of the animal food, 4.92 per cent.

Following is a list of the insects identified in the stomachs and the number of stomachs in which each is contained:

HYMENOPTERA (bees and wasps).

Vespa sp	1
Chrysis sp	1
Ophion sp	1
Pogonomyrmex sp	4

COLEOPTERA (beetles).

Cicindela rectilatera	2
Cicindela schauppii	2
Megilla maculata	1
Coccinella abdominalis	1
Hister abbreviatus	1
Acmæodera militaris	1
Ellychnia corrusca	1
Chauliognathus marginatus	2
Canthon lecontei	4
Canthon cyanellus	1
Canthon lævis	1
Canthon sp	2
Onthophagus pennsylvanicus	1
Onthophagus sp	1
Bolboceras farctus	1
Dichelonycha sp	1
Lachnosterna sp	1
Euphoria fulgida	1
Euphoria inda	1
Stenosphenus delosus	1
Cyllene crinicornis	2
Cyllene robiniæ	1
Leptura sp	1
Oberea sp	1
Cryptocephalus cribripennis	1
Diabrotica 12-punctata	1
Macrobasis albida	4
Epicauta lemniscata	2
Epicauta funebris	4
Epicauta sp	1
Ophryastes tuberosus	2
Phacepholis elegans	1
Anthonomus grandis	4
Balaninus sp	2
Calandra oryzæ	1

LEPIDOPTERA.

Cotton leaf worm (*Alabama argillacea*)	3
Cotton bollworm (*Heliothis obsoleta*)	1

HEMIPTERA (bugs).

Cicada sp	1
Aulacizes irrorata	1
Stiretrus anchorago	1
Œbalus pugnax	1
Euschistus servus	1
Euschistus sp	1
Thyanta custator	2
Anasa tristis	2
Phymata sp	1
Zaitha sp	1

ORTHOPTERA (grasshoppers, crickets, etc.).

Syrbula acuticornis	1	*Chortophaga viridifasciata*	1
Melanoplus femur-rubrum	1	*Tettigidea lateralis*	1
Melanoplus sp	1	*Gryllus* sp	9

NEUROPTERA

Mantispa brunnea	3	*Mantispa* sp	1

Vegetable food.—The vegetable food consists of small fruit, or berries, and a few seeds. The total percentage, 3.88, indicates that this is not the favorite kind of food, but is taken for variety.

Summary.—It needs but little study of the food of the scissor-tailed flycatcher to show that where the bird is abundant it is of much economic value. Its food consists almost entirely of insects, including so few useful species that they may be safely disregarded. Its consumption of grasshoppers is alone sufficient to entitle this bird to complete protection.

THE KINGBIRD.

(*Tyrannus tyrannus.*)

The kingbird (frontispiece), sometimes known as the bee martin, inhabits nearly the whole of the United States and extends north far into British America. It is much less abundant in the southwestern part of the country, having never been taken in Arizona and rarely in California. In winter it passes beyond the southern boundary of the United States. It is one of the largest of our flycatchers and probably the most common one east of the Rocky Mountains.

The favorite haunts of the kingbird are orchards and open pastures, and it will often nest in the near vicinity of farm buildings. Many cases are on record where chickens and other poultry have been saved from hawks by the timely interference of kingbirds that were nesting near by. This habit of the bird was noted by observers more than two centuries ago. Thus we find in Josselyn's Voyages to New England (published in 1675, p. 96) the following account:

"There is a small Ash-color Bird * * * that falleth upon Crows, mounting up into the air after them, and will beat them till they make them cry."

The kingbird seems to be by nature very pugnacious and noisy, and when it nests in orchards in the vicinity of robins, a constant warfare is kept up between the two species. While the plumage of this bird is not conspicuously colored, it has upon its head a concealed crown patch of brilliant orange or scarlet which can be brought into view by the erection of the coronal feathers.

In the investigation of the food of the kingbird 665 stomachs were examined. They were taken in the months from March to October, inclusive, though only 3 were collected in March and 1 in October. The other months were well represented. Geographically they are distributed through 29 States, the District of Columbia, and British America. The food is composed of 88.93 per cent of animal matter to 11.07 of vegetable. The former is made up of insects and a few spiders, the latter is mostly small fruit.

Animal food.—Useful beetles, mostly the predaceous ground beetles (Carabidæ), amount to 4.64 per cent for the whole period. The 1 stomach taken in October contained 12 per cent, but in July, when 157 stomachs were examined, the average was less than 7 per cent. The rose chafer, more commonly known as the rose bug (*Macrodactylus subspinosa*), is not much eaten by birds. It comes, usually in swarms, about the month of June when the roses bloom. It is very destructive to roses and some other flowers. The kingbird seems to have a special liking for this insect, as it was found in 24 stomachs and 1 contained 40 individuals. Other beetles identified, that are of special economic importance, are the asparagus beetle (*Crioceris asparagi*), the spotted cucumber beetle (*Diabrotica 12-punctata*), and the locust leaf miner (*Odontota dorsalis*). The last sometimes completely defoliates locust trees. One stomach held over 100 specimens of a small dung beetle (*Aphodius inquinatus*), which sometimes flies in swarms in the late afternoon, when it is probably taken by the kingbird. A few stomachs were collected in the cotton fields of Texas, and 4 of them contained remains of the notorious cotton-boll weevil (*Anthonomus grandis*). Several other stomachs contained the clover-leaf weevil (*Phytonomus punctatus*) and the imbricated snout beetle (*Epicærus imbricatus*). All of these are pests, and the latter seems to feed upon nearly every variety of fruit and vegetable. *Sphenophorus zeæ*, the corn weevil, which feeds upon the roots and stalks of corn, was identified in 1 stomach.

Perhaps the most surprising and unexpected components of this bird's food are the blister beetles (Meloidæ). They appear in the food to some extent in every month in which stomachs were collected (except the 1 stomach in October); and in September, when 46 stomachs were taken, they amount to 11.55 per cent of the whole food for that month. For the entire eight months they aggregate 2.69 per cent, which is not a large percentage, but the wonder is that they are eaten at all. As is well known, these insects contain the drug commonly known as cantharadin, which beside its property of blistering the skin produces other peculiar physiological effects when taken internally. It seems hardly credible that a bird could eat without harm an insect that causes a blister when crushed upon the human skin, but that this bird does eat them, and apparently as many of them as it can get, is shown by the fact that 8 of these beetles were found in 1 stomach, 10 in another, 11 in each of 2 others, 13 in each of 4, and 14 in another. They were found in 70 stomachs, or over 11 per cent of the whole, and in 1 stomach they constituted 97 per cent of the contents and in several others the percentage was nearly as great. The species identified from the stomachs are *Epicauta trichrus*, *E. cinerea*, *E. pennsylvanica*, *Macrobasis unicolor*, *Nemognatha cribricollis*, and *Meloe americanus*. Other beetles, all of which belong to more or less harmful families, amount to 18.02 per cent. If to these we add the Carabidæ and Meloidæ, we have an aggregate of 25.35 per cent of beetles in the diet, the largest item but one.

Hymenoptera amount to 32.39 per cent of the food, the largest item. Of these probably about one-fourth are parasitic species that must be reckoned as useful insects. Of the others the one which has attracted most attention in connection with the kingbird is the common honeybee (*Apis mellifera*). The bird has for years had the reputation of catching honeybees to an injurious extent; indeed, some bee keepers declare that if left to prey upon the bees unmolested it will destroy the whole colony. The testimony upon this point, however, is very contradictory, and other observers equally reliable say that the bird takes few, if any, bees, and still others declare that it takes only the useless drones.

The following are samples of testimony upon this point:

Mr. I. N. Arnold, writing from Richmond, Ohio, under date of September 5, 1885, says:

> The bee martin, or kingbird, is very destructive to bees. * * * I have seen the kingbird bring its young as soon as they could fly and stay close to the apiary and feed exclusively on bees. They are most destructive to bees that are coming in laden, and they are liable to catch a valuable queen when she is out to mate. I am running a large apiary, and have been annoyed a great deal by the bee birds.

Mr. P. R. Staunton, of Le Roy, N. Y., says:

> The kingbird feeds upon bees. It is especially dangerous when bees are swarming, as there is danger then of losing the queen. Every apiarist keeps a gun in his yard ready to entertain the kingbird. The bird will hover in the air and snap up bees as rapidly as they come within reach. * * * Every snap of the bill means a bee lost.

The following from Mr. J. P. H. Brown, of Augusta, Ga., under date of September, 1886, gives a different view of the subject:

> In regard to birds feeding on the honeybee, I can speak positively on the subject. I keep from 150 to 200 colonies of Italian bees, and make the breeding of queen bees a specialty. For the last 15 years I have made the habits of the birds infesting my apiary a study. They are mocking birds, bee martins, redbirds, and catbirds. They build their nests in the shrubbery and trees in my apiary. Bee keepers generally give these birds a bad reputation and exterminate them. I have watched the bee martin, the worst reputed bird of the lot, at times when I thought I saw him take a bee, shot him, and quickly opened his crop. Thus far I have failed to find anything in it like a worker bee. I have often detected the remains of drone bees and other insects; hence I have ceased to destroy the birds and allow them to have full liberty. The drone or male bees have no sting, and birds, as well as very young chickens, can soon learn to distinguish a drone from a worker.

Of 665 stomachs examined, honeybees were found in 22. The total number in these 22 stomachs was 61, of which 51 were drones, 8 were workers, and 2 indeterminate. When we consider that in the stomachs examined there must have been at least 10,000 insects, and probably three times that number would be nearer the mark, it will at once be seen that the proportion of honeybees in the kingbird's diet is small.

Other Hymenoptera in the kingbird's food are ordinary bumblebees, wasps, and hornets of various species, of which probably the best that can be said is that they perform a useful function in the fertilization of flowers. As there is little danger that there will ever be too few of them for this service, the birds are doing no great harm in feeding upon the surplus.

Hemiptera (bugs) are not an important element of the kingbird's food, though they were found in the stomachs of every month except March. In April they amount to 7.25 per cent, which is the highest of any month. The average for the year is 3.77 per cent. As might be expected, the species are such as can be taken on the wing and do not include such sedentary creatures as scales and plant lice. Stinkbugs (Pentatomidæ) and cicadas, with a few assassin bugs (Reduviidæ), make up the bulk of this item.

Diptera (flies) are eaten by the kingbird in only moderate quantities, though they appear in the stomachs of every month except the one taken in October. The maximum percentage, 8.36, occurs in May, and the average for the year is 3.19 per cent. They belong to several families, but one is of especial interest in relation to the kingbird and honeybees. This is the family of the robber flies (Asilidæ), most of which are large, long-bodied, hairy creatures that fly with a loud, buzzing sound and are usually seen about flowers in bright sunshine, preying upon the insects that come to the flowers for honey. They might be thought to be useful insects were it not for the fact that some species have a special liking for honeybees, which they kill in considerable numbers. The late Dr. Riley states that one species (*Promachus fitchii*) has been known to kill 141 honeybees in a single day. Mr. T. J. Parrish, writing from Gainesville, Tex., in 1886, refers to robber flies as follows:

> The kingbird does not feed upon bees, but an insect about three times as large as the bee, which carries off honey-laden bees, kills them, and appropriates the honey. It is a hump-backed, long-tailed, spider-legged monstrosity, of rapid flight, and appears in July and August.

Prof. A. J. Cook, a well-known authority on bees, in an article on the natural enemies of the honeybee, speaks of these flies as follows:

> Among Diptera the family Asilidæ (robber flies) afford the most serious pests to the apiarist * * *. There are at least 3 species of *Asilus*, 2 of *Mallophora*, 2 of *Promachus*, 2 of *Laphria*, and 2 of *Erax* that catch and kill bees. These predaceous flies work the most serious mischief south, but are not exempt from blame even as far north as Ontario.[1]

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[1] American Naturalist, XV, p. 200, 1881.

Robber flies were found in 19 of the stomachs, and 1 contained 6 individuals. In all, 26 were identified, which would seem to be abundant payment for the 8 worker bees. A few syrphus and tachinid flies and a number of the long-legged crane flies (Tipulidæ) make up the rest of the Diptera of the kingbird's diet.

Lepidoptera (moths, butterflies, and their larvæ) form 3.18 per cent of the food of the kingbird. Most birds eat adult Lepidoptera (moths and butterflies) but sparingly, preferring their larvæ, commonly known as caterpillars. The flycatchers, however, eat quite a number of moths as well as caterpillars. They were found in the stomachs of the kingbird in nearly every month except March and October, when but few stomachs were taken. Beginning with a maximum of 5.60 per cent in April, they decrease quite regularly to a minimum of 2.87 per cent in July, after which they again increase to 4.61 per cent in September. The cotton worm (*Alabama argillacea*) is the only insect of this order found in the stomachs which is of any special interest. This was found in a few stomachs of birds taken in the cotton fields of Texas and was in the larval or caterpillar state. Other Noctuidæ (cutworms) either as adults or larvæ were identified in seven stomachs.

Orthoptera (grasshoppers, crickets, etc.) stand third in importance in the kingbird's food and during July and August exceed any other element. None were found in the stomachs taken in March and October, but in April they amounted to 2.40 per cent, from which they gradually increased to 32.83 in August, and then rapidly decreased and disappeared. The average for the year was 11.83 per cent. Like many other eastern birds, the kingbird takes advantage of the abundance of grasshoppers in July and August and replaces some other articles of diet with them. Besides the insects already enumerated, the kingbird eats some dragon flies and ephemerids, with an occasional raphidian, and now and then a scorpion fly (*Panorpa*), in all making 1.52 per cent of the diet. The bones of a tree frog, those of a lizard, a few crustaceans (*Oniscus*), commonly known as sow bugs, and the shell and lingual ribbon of a snail were also found. These last were evidently not regular articles of diet and amounted to only 1.29 per cent.

Following is a list of the animal food identified in the stomachs and the number of stomachs in which each species occurred:

HYMENOPTERA (wasps, bees, etc.).

Apis mellifera	22	*Megachile* sp	1
Bombus vagans	1	*Cœlioxys 8-dentata*	1
Bombus sp	1	*Andrena* sp	2
Melissodes sp	5	*Agapostemon* sp	3
Epeolus sp	1	*Halictus* sp	3
Xylocopa sp	1	*Colletes* sp	1
Megachile brevis	1	*Crabro* sp	2

Bembex fasciata	1
Ammophila gryphus	1
Ammophila varipes	2
Ammophila sp	2
Pompilus sp	2
Vespa germanica	1
Vespa maculata	2
Polistes sp	1
Odynerus sp	3
Chrysis sp	1
Myzine 6-cincta	2
Myzine sp	2
Tiphia inornata	3
Tiphia tarda	1
Tiphia sp	2
Cremastogaster pennsylvanica	5
Solenopsis debilis	1
Myrmica sp	1
Aphænogaster fulva	1
Aphænogaster tennesseense	1
Aphænogaster sp	1
Camponotus esuriens	1
Camponotus sp	2
Lasius alienus	1
Lasius sp	2
Formica fusca	11
Formica integra	1
Formica schaufussi	1
Formica sp	2
Ichneumon lætus	1
Ichneumon sp	2
Cryptus americanus	1
Cryptus sp	2
Lampronota sp	1
Pimpla sp	1
Xylonomus sp	1
Ophion bilineatum	1
Ophion sp	4
Limneria sp	1
Paniscus geminatus	1
Tremex columba	1
Tremex sp	1

COLEOPTERA (beetles).

Cicindela purpurea	3
Cincindela vulgaris	2
Cicindela 12-guttata	1
Cicindela punctulata	2
Cicindela sp	7
Calosoma calidum	2
Elaphrus sp	1
Clivina sp	1
Pterostichus sayi	1
Pterostichus sp	1
Amara exarata	2
Amara impuncticollis	2
Amara bipunctata	1
Amara sp	3
Calathus gregarius	2
Platynus sp	2
Lebia grandis	2
Chlænius sp	1
Geopinus incrassatus	1
Cratacanthus dubius	3
Agonoderus lineola	1
Agonoderus pallipes	2
Harpalus pennsylvanicus	1
Harpalus sp	5
Anisodactylus rusticus	2
Anisodactylus discoideus	2
Anisodactylus baltimorensis	2
Anisodactylus sp	5
Sphæridium scarabæoides	2
Necrophorus guttata	1
Staphylinus cinnamopterus	2
Staphylinus sp	1
Philonthus sp	3
Coccinella 9-notata	2
Coccinella sanguinea var. *munda*	1
Anatis ocellata	1
Hister cænosus	2
Hister abbreviatus	2
Hister americanus	1
Saprinus assimilis	1
Trogosita virescens	1
Melanotus sp	3
Limonius auripilis	1
Limonius sp	3
Athous sp	1
Corymbites hieroglyphicus	1
Dicerca obscura	1
Dicerca sp	1
Agrilus sp	1
Phengodes fusiceps	1
Chauliognathus pennsylvanicus	12
Chauliognathus marginatus	11
Chauliognathus sp	6
Podabrus diadema	3
Telephorus carolinus	1
Telephorus rotundicollis	2
Telephorus bilineatus	2
Amphicerus punctipennis	1
Canthon praticola	1
Canthon lævis	1

Canthon sp	1
Copris sp	1
Onthophagus nuchicornis	1
Onthophagus hecate	5
Onthophagus sp	14
Atænius cognatus	2
Atænius sp	2
Aphodius fossor	3
Aphodius fimetarius	57
Aphodius ruricola	1
Aphodius granarius	1
Aphodius inquinatus	7
Aphodius rubeolus	1
Aphodius sp	6
Bolboceras farctus	11
Dichelonycha elongata	1
Dichelonycha subvittata	1
Dichelonycha sp	10
Macrodactylus subspinosus	31
Lachnosterna congrua	3
Lachnosterna fusca	1
Lachnosterna sp	5
Anomala binotata	3
Anomala varians	4
Anomala lucicola	1
Anomala marginata	1
Anomala sp	8
Strigoderma pygmæa	1
Aphonus tridentatus	1
Allorhina nitida	1
Euphoria sepulchralis	1
Euphoria melancholica	2
Euphoria fulgida	1
Euphoria inda	4
Euphoria sp	1
Cremastochilus knochii	2
Cremastochilus castaneæ	3
Cremastochilus sp	7
Anthophilax malachiticus	1
Strangalia luteicornis	1
Typocerus zebratus	1
Leptura cordifera	1
Leptura sp	1
Monohammus scutellatus	1
Dectes spinosus	1
Oberea sp	2
Crioceris asparagi	1
Cryptocephalus venustus	1
Cryptocephalus leucomelas	1
Typophorus viridicyanea	3
Chrysomela pulchra	1
Chrysomela elegans	1
Gastroidea sp	1
Lina trilineata	1
Diabrotica 12-punctata	3
Disonycha sp	1
Odontota dorsalis	2
Chelymorpha argus	5
Chelymorpha cribraria	2
Epitragus acutus	1
Scotobates calcaratus	2
Tenebrio molitor	1
Opatrinus aciculatus	1
Meloe americanus	1
Meloe sp	1
Nemognatha cribricollis	1
Macrobasis unicolor	4
Epicauta trichrus	1
Epicauta cinerea	2
Epicauta funebris	5
Epicauta pennsylvanica	2
Epicauta sp	3
Epicærus imbricatus	3
Phytonomus punctatus	13
Anthonomus grandis	5
Balaninus sp	1
Rhodobænus 13-punctatus	1
Sphenophorus costipennis	1
Sphenophorus melanocephalus	1
Sphenophorus zeæ	4

DIPTERA (flies).

Tabanus tener	1
Tabanus sp	1
Deromyia sp	1
Promachus sp	1
Proctacanthus milberti	1

LEPIDOPTERA (butterflies and moths).

Agrotis sp	1
Alabama argillacea	2

MECOPTERA.

Panorpa sp (scorpion fly)	2

ODONATA (dragon flies).

Agrion sp	3
Diplax intacta	2

NEUROPTERA.

Mantispa sp	1

HEMIPTERA (bugs).

Tibicen cruentifera	1
Tibicen sp	1
Podisus spinosus	1
Euschistus variolarius	1
Euschistus fissilis	1
Euschistus sp	7
Hymenarcys nervosa	1
Lygæus turcicus	1
Phymata fasciata	1
Sinea diadema	7
Gerris marginatus	1
Hydrometra sp	1

ORTHOPTERA (grasshoppers, crickets, etc.).

Melanoplus femur-rubrum	19
Melanoplus sp	24
Chortophaga viridifasciata	4
Camnula pellucida	1
Dissosteira carolina	2
Tettix sp	2
Udeopsylla robusta	1
Nemobius vittatus	1
Gryllus sp	2
Œcanthus sp	1

CHILOGNATHA.

Julus sp. (milleped)	2

ARACHNIDA (spiders).

Attus sp	1
Lycosa sp	1

Vegetable food.—The vegetable food of the kingbird amounts to 11.07 per cent of its diet, and consists of small fruit, with an occasional seed. Altogether it was found in 302 stomachs. None was contained in the three stomachs taken in March nor in the one taken in October, but beginning with less than 2 per cent in April there is a steady increase to 35.50 per cent in September. Of uncultivated small fruits 25 species were identified, not counting the rubus fruits (raspberries and blackberries), which may have been either cultivated or wild. These last were found in 74 stomachs, which is more than in any other species. Cultivated cherries were identified in 11 stomachs; strawberries, which may have been wild, in 2; figs in 1; and currants in 1. Grapes were contained in several stomachs, but were apparently all of wild species. A few seeds were found and some bits of rubbish, but these were probably swallowed accidentally with an insect or other food.

Following is a list of fruit and seeds identified in the stomachs:

Dandelion (*Taraxacum officinale*)	1
Common elder (*Sambucus canadensis*)	5
Elder (*Sambucus* sp.)	6
Common nightshade (*Solanum nigrum*)	1
Blueberry (*Vaccinium* sp.)	19
Huckleberry (*Gaylussacia* sp.)	4
Alternate-leaved dogwood (*Cornus alternifolia*)	1
Panicled dogwood (*Cornus paniculata*)	1
Rough-leaved dogwood (*Cornus asperifolia*)	20
Kinnikinnik (*Cornus amomum*)	2

Dogwood (*Cornus* sp.)	5
Fox grape (*Vitis vulpina*)	1
Frost grape (*Vitis cordifolia*)	6
Northern fox grape (*Vitis labrusca*)	1
Virginia creeper (*Psedera quinquefolia*)	5
Bluewood (*Condalia obovata*)	1
Buckthorn (*Rhamnus lanceolatus*)	4
Sumac (*Rhus* sp.)	1
Domestic cherry (*Prunus* sp.)	11
Bird cherry (*Prunus pennsylvanica*)	4
Chokecherry (*Prunus virginiana*)	10
Wild black cherry (*Prunus serotina*)	8
Blackberry and raspberry (*Rubus* sp.)	74
Strawberry (*Fragaria vesca*)	2
June berry (*Amelanchier canadensis*)	5
Chokeberry (*Pyrus arbutifolia*)	1
Currant (*Ribes* sp.)	1
Spicebush (*Benzoin æstivale*)	8
Sassafras (*Sassafras variifolium*)	18
Pokeberry (*Phytolacca decandra*)	10
Amaranth (*Amaranthus* sp.)	1
Fig (*Ficus* sp.)	1
Mulberry (*Morus* sp.)	14
Bayberry (*Myrica carolinensis*)	3
Foxtail grass (*Setaria* sp.)	1
Red cedar (*Juniperus virginianus*)	2
Sedge (*Rhynchospora* sp.)	1
Grass seed not further identified	2
Fruit pulp not further identified	42
Seeds not further identified	7

Summary.—From the above discussion of the vegetable food of the kingbird it is evident that the bird's economic status is to be determined entirely by its animal food, as the vegetable portion is practically neutral. Of the animal part the largest item, Hymenoptera, is composed largely of insects indirectly beneficial to the interests of man. A portion of them are parasitic upon caterpillars and other injurious species and probably are largely instrumental in holding these in check. On the other hand, they parasitize useful insects, and even the parasites themselves are destroyed by other parasite (hyperparasites). Other members of the order, such as wasps and bees, perform a useful function in pollenizing flowers. For these reasons the destruction of Hymenoptera in general can not be considered altogether desirable.

In the destruction of other kinds of insects the kingbird is conferring an almost unmixed blessing. A few of the beetles are theoretically useful, but bugs, grasshoppers, flies, and caterpillars embrace some of the worst pests to agriculture, and these, with the harmful beetles and a few miscellaneous insects, constitute 50 per cent of the kingbird's food. The internal relations of the other 50 per cent of the food are such as to render it neutral as a whole, thus leaving a balance of 50 per cent to the kingbird's credit.

ARKANSAS KINGBIRD.

(*Tyrannus verticalis.*)

The Arkansas kingbird (Pl. II) occupies during the breeding season the western portion of the United States from the Pacific Ocean eastward as far as Minnesota, Kansas, and Texas, though stragglers have been taken east of this line. It extends northward into British America, where it breeds, but in winter it retires entirely beyond the southern boundary of the United States. It is a bird of the open country and avoids forests. A hilly country with here and there trees for nesting sites seems to be the ideal habitat. It takes kindly to civilization and the vicinity of gardens and buildings. Not rarely it nests in trees on the village streets and in some cases actually places its nest upon the structures of man; but in general it is less domestic than its eastern relative, whose nest is so often built in an orchard. It does not seem to have that antipathy to hawks and other birds so characteristic of the eastern kingbird, and a case is on record where it has built its nest on the same tree with a hawk and a Bullock's oriole.[1]

For the investigation of the food of the Arkansas kingbird 109 stomachs were available. They were collected in the months of March to October, inclusive, with 3 taken in December. The greater number of them are from California, but a few were collected in 6 other States. The food is found to consist of 90.61 per cent of animal matter to 9.39 per cent of vegetable. Of the animal portion, Hymenoptera (bees and wasps), Coleoptera (beetles), and Orthoptera (grasshoppers) constitute over three-fourths.

Animal food.—Beetles of all kinds amount to 17.02 per cent of the food, and include 5.47 per cent of useful species, mostly Carabidæ and Cicindelidæ. For a flycatcher this is a large record of these useful beetles, as they are largely ground-inhabiting species and not so often on the wing as most others. The remainder, 11.55 per cent, are either harmful or neutral. No special pests were found among them. Hymenoptera (bees and wasps) are the largest item of animal food and amount to 31.38 per cent. They form a good percentage of the food in every month except August, when they are partly replaced by grasshoppers. A few of the parasitic species were found, but not many. Honeybees (*Apis mellifera*) were noted in 5 stomachs. In all, there were 31 bees, of which 29 were males, or drones, and 2 were workers. This bird has been accused in California of eating honeybees to an injurious extent. It was said that the bird lingered near the hive and snapped up the honey-ladened bees as they returned from the field. This statement is not borne out by the facts stated above.

Hemiptera (bugs) are a small but rather regular constituent of the food of the Arkansas kingbird and were found in the stomachs of every month except October. March appears to be the month of maximum consumption, 19 per cent, but this can not be taken as proved, for only 3 stomachs were taken in that month. June, with 9.86 per cent from 28 stomachs, is more likely to be the month of true maximum. They belong to the stinkbug family, the leaf bugs (Capsidæ), and the shield-backs (Scutelleridæ), with a few cicadas. Altogether bugs amount to 5.36 per cent of the food.

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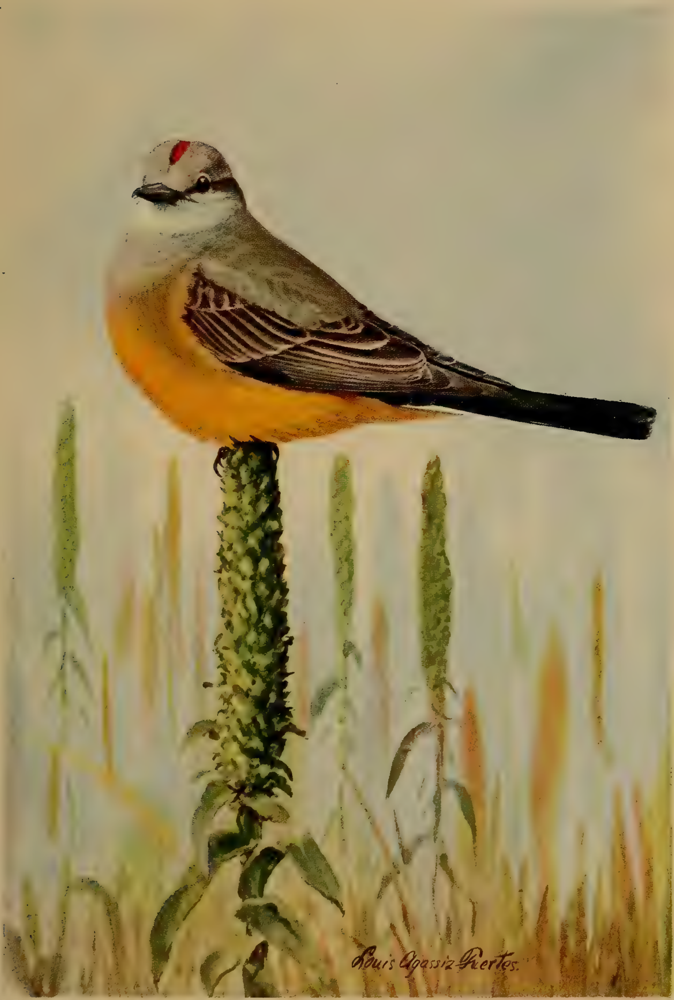
[1] Bendire, C. E., Life Histories of North American Birds, I, p. 246, 1892.


Louis Agassiz Fuertes.

ARKANSAS KINGBIRD.

Diptera (flies) constitute 0.55 per cent of the diet. In June 3.21 per cent were taken, but in no other month do they reach 1 per cent, and in March, September, October, and December none at all were eaten. This bird is apparently not much of a "flycatcher." Lepidoptera (moths and butterflies), including both adult moths and caterpillars, amount to 7.31 per cent of the food. When eaten at all they appear to constitute a fair percentage of the daily diet, but they are entirely absent from the stomachs of March, September, and October. A greater number of stomachs, however, might give a somewhat different result.

Orthoptera (grasshoppers, crickets, etc.) stand next to Hymenoptera in the diet of the Arkansas kingbird. March appears to be the month of least consumption, as the 3 stomachs taken then showed only 3.33 per cent while the 3 taken in December contained 44 per cent. In all the other months they constitute a good percentage of the food, and, as seems natural, August is the month of maximum consumption, with 61.58 per cent. The total for the year is 27.76 per cent. It is a singular fact that several western species of flycatchers eat more grasshoppers than do the meadowlark and blackbirds, which obtain their food almost wholly upon the ground. The reverse is the case with the corresponding eastern birds. The orthopterous food consists almost entirely of grasshoppers with very few crickets.

Dragon flies and a few other miscellaneous insects, millepeds and spiders, the bones of tree frogs in 3 stomachs, and egg shells, apparently those of a domestic fowl, make up the remainder of the animal food, 1.23 per cent.

Following is a list of the insects identified and the number of stomachs in which each was found:

HYMENOPTERA (bees and wasps).

Apis mellifera	5	*Prosopis affinis*	1
Melissodes sp	1	*Cryptus* sp	1
Habropoda sp	1	*Ophion bilineatus*	1
Andrena sp	1	*Ophion* sp	1

COLEOPTERA (beetles).

Platynus sp	1	*Onthophagus* sp	2
Anisodactylus baltimorensis	1	*Aphodius fimetarius*	2
Anisodactylus semipunctatus	1	*Aphodius* sp	2
Agabus sp	1	*Bolboceras farctus*	1
Hydaticus stagnalis	1	*Geotrupes* sp	1
Silpha ramosa	1	*Amphicoma ursina*	5
Staphylinus nigrellus	1	*Euphoria inda*	1
Staphylinus luteipes	1	*Euphoria* sp	1
Hister americanus	1	*Cremastochilus* sp	3
Megapenthes turbulentus	1	*Leptura instabilis*	1
Canthon lævis	1	*Epicauta* sp	1
Onthophagus hecate	1	*Balaninus* sp	1

DIPTERA (flies).

Bombylius sp	1

HEMIPTERA (bugs).

Eurygaster alternatus	1	*Nezara* sp	2
Podisus modestus	1	*Calocoris rapidus*	1
Euschistus servus	1		

Vegetable food.—Although vegetable food amounts to 9.39 per cent, it presents but little variety. A few weed seeds occurred in one stomach. Seeds and skins of elderberries (Sambucus) were found in 11 stomachs, woodbine (Psedera) in 2, hawthorn berries (Cratægus) in 1, an olive in 1, and skin and pulp of fruit not further identified in 2.

The following fruits were found in the stomachs:

Virginia creeper (*Psedera quinquefolia*)	2	Elderberry (*Sambucus* sp.)	11
Hawthorn (*Cratægus* sp.)	1	Olive (*Olea europæa*)	1

Summary.—The vegetable food of the Arkansas kingbird is of so little economic importance that it may be dismissed without further comment. The animal food is open to adverse criticism in only one point—the useful beetles. But even if it be admitted that the destruction of these is harmful to man's interests, the amount of damage is so small as to be completely overbalanced by the good done in other directions. The charge that the bird destroys honeybees is not sustained by the results of this investigation. On the whole, it appears that the Arkansas kingbird is one of the most useful birds in the region where it is found.

CASSIN'S KINGBIRD.

(*Tyrannus vociferans.*)

Cassin's kingbird occupies in the breeding season the western portion of the United States from the eastern slope of the Rocky Mountains westward to the Pacific and north to central California and southern Wyoming. It is rather irregularly distributed in this region and is entirely wanting over considerable areas. Like the two preceding species it prefers open, parklike country to forests, but it is said to be more of a mountain bird and to breed at higher altitudes. The habits of the bird must differ somewhat in different localities or at different seasons. Maj. Bendire says of it: "Cassin's kingbird is neither as noisy nor as quarrelsome as the preceding species" [*T. verticalis*].[1]

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[1] Life Histories of North American Birds, I, p. 250, 1895.

Speaking of the same species, Dr. Edgar A. Mearns says:

> On the Mogollon Mountains I saw them attack crows and western red-tailed hawks and drive them from the neighborhood of their nests after the spirited fashion of the eastern kingbird.[1]

Only 40 stomachs of Cassin's kingbird were available for the study of its food. They are distributed very irregularly over the year, and none were taken in April, May, July, and August. While this scanty supply of material may give us some information as to what the bird eats, it can not furnish reliable data as to relative proportions. The food was found to be composed of 78.57 per cent of animal matter to 21.43 of vegetable.

Animal food.—Beetles of all kinds amount to 14.91 per cent of the food. Of these, about 1 per cent are of species that are more or less useful (Carabidæ). The others are Scarabæidæ, Cerambycidæ (*Saperda* sp.), Elateridæ, and Histeridæ (*Hister sellatus*). Hymenoptera amount to 21.61 per cent and consist for the most part of wild bees and wasps. No honeybees were found, but several predaceous or parasitic species were identified, such as *Tiphia inornata* and *Myzine 6-cincta*. As with many other flycatchers, Hymenoptera are the largest item of food. Hemiptera (bugs) are eaten rather irregularly and not in large quantities. They amount to 3.41 per cent. The only ones identified were of the family Pentatomidæ (stinkbugs). Diptera constitute only 2.91 per cent of the diet, which again illustrates the fact that some flycatchers do not catch many flies. They belong to the long-legged crane-fly family (Tipulidæ) and the family of the house fly (Muscidæ).

Lepidoptera, i. e., moths and caterpillars, amount to 18.21 per cent of the food, which is a high percentage for a flycatcher; for while moths may be caught on the wing, caterpillars must be picked from the surface on which they crawl, unless they let themselves down from a tree by a thread and so hang in mid-air. Caterpillars were found in 11 stomachs and moths in 6. Of the latter, 21 individuals were made out in 1 stomach. They are probably a very popular article of diet with this bird, as they appear in the food of every month, but in rather irregular amounts. More stomachs would probably give a more regular record. Orthoptera (grasshoppers and crickets) are apparently eaten rather irregularly, but as nearly every month in which they appeared at all showed a goodly quantity, they would seem to be a favorite food, and it is probable that a greater number of stomachs would give a more regular showing. In January they amount to 47.50 per cent in 4 stomachs, while the 1 stomach taken in February shows none at all. It is not probable, however, that January is really the month of maximum consumption of grasshoppers.

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[1] The Auk, VII, p. 255, 1890.

The total for the year is 14.67. Had any stomachs been collected in August, the grasshopper month, there is little doubt that this record would have been considerably raised. A few dragon flies and some spiders make up the balance of the animal food, 2.85 per cent.

Vegetable food.—Although Cassin's kingbird eats more vegetable food than any other flycatcher, there is very little variety to it. Grapes, apparently of cultivated varieties, were found in 9 stomachs, olives in 2, elderberries in 1, blueberries (*Vaccinium*) in 1, and pulp not further identified in 4. With the exception of some grapes found in 1 of the March stomachs, all the fruit was eaten in the months from September to January, inclusive.

Summary.—In the choice of its animal food Cassin's kingbird does but little harm, as it eats only a few predaceous or parasitic insects, nor, so far as this investigation shows, does it attack honeybees. In selecting its vegetable food it shows considerable fondness for cultivated fruits, but no bird so thoroughly insectivorous as this flycatcher will ever become a menace to fruit culture.

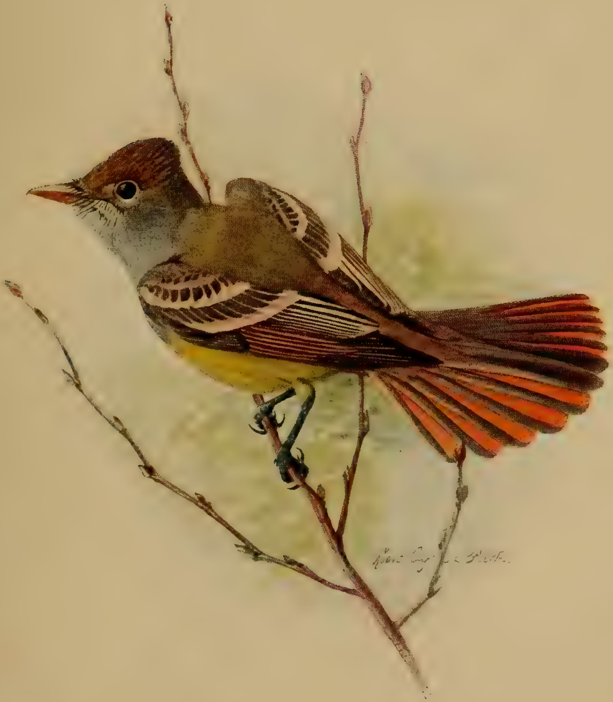
CRESTED FLYCATCHER.

(*Myiarchus crinitus.*)

The crested flycatcher (Pl. III) occupies practically all that portion of the United States east of the Rocky Mountains and extends northward into southern Canada. It is somewhat more of a bird of the forest than the kingbirds, but, like them, frequents the open country and delights in orchards, especially if they be old with many hollow trees to serve as nesting sites. While extending over a vast area of country it is very irregularly distributed, being abundant in some portions and rare or wholly wanting in others. In winter it leaves the United States almost wholly, a few individuals only remaining in southern Florida and Texas.

For the investigation of the food of this bird 265 stomachs were available, which were obtained during the 6 months from April to September, inclusive. They were collected in 20 States, the District of Columbia, and Canada. In the first analysis the food divides into 93.70 per cent of animal matter to 6.30 per cent of vegetable.

Animal food.—Beetles constitute 16.78 per cent of the food, and of these 0.24 per cent are useful species. The remainder are mostly of an injurious character, some of them very harmful. The notorious cotton-boll weevil (*Anthonomus grandis*) was found in 2 stomachs taken in Texas, the strawberry weevil (*A. signatus*) in 1, and the plum curculio (*Conotrachelus nenuphar*) in 2. Besides these pests were the locust leaf miner (*Odontota dorsalis*) and species of *Balaninus*, which have been discussed in previous pages. While the record does not indicate any special preference for the harmful beetles, it does show that they are eaten as often as the average of the different



Crested Flycatcher

species. The month of maximum consumption of beetles is June with 25.81 per cent. After this they gradually decrease, but maintain a fair percentage through the season. Representatives of 12 different families were identified.

Hymenoptera amount to 13.69 per cent; more than 3 per cent less than the beetle food. Only one other flycatcher under investigation, the scissortail, eats more beetles than wasps and bees. Some of the useful parasitic species are included in this item, but the proportion is not large. Sawflies in the larval form were found in 6 stomachs and were the entire contents of 1. These are destructive insects. One worker honeybee was found, which was the only indication that the bird ever preys upon the occupants of the hive. May appears to be the month of maximum consumption of Hymenoptera, but every month shows a good percentage. Diptera (flies) amount to only 3.06 per cent, and while they are eaten to some extent in every month the amount is small, and the maximum, which occurs in July, is only 6.32 per cent—another illustration of the fact that flycatchers catch more of other insects than of flies. No species of special interest were noted, except one robber fly (Asilidæ), which can be taken as an offset to the honeybee. Horseflies (Tabanidæ) were noted in 14 stomachs, which would seem to indicate that they are the favorites among Diptera. Hemiptera (bugs) constitute 14.26 per cent of the diet. They belong to the usual families of stinkbugs, tree hoppers, leaf hoppers, and cicadas, with a few assassin bugs. The cicadas were more than usually abundant, being found in 8 stomachs, and in 1 they were the entire food. Stinkbugs (Pentatomidæ) were found in 44 stomachs, and 1 was entirely filled with them. These highly flavored insects are often eaten by birds, but usually only a small quantity is found in each stomach. Orthoptera, i. e., grasshoppers, crickets, and katydids, seem to be one of the favorite foods of the crested flycatcher. They were found in 45 stomachs and constituted the only food in 3. Beginning with 8.64 per cent in April the consumption steadily increases to September, when it is 23.18 per cent, though August is but a trifle less. The average of all the months is 15.62 per cent. Only 2 flycatchers have a greater record of grasshoppers than this.

Lepidoptera (moths and their larvæ) are the largest item of the food. Caterpillars were found in 73 stomachs and the adults, as moths, in 48. This last is a somewhat unusual showing, as adult moths and butterflies are not a favorite food with birds in general. It is evident that the larvæ—i. e., caterpillars, are generally preferred to the adult insects, but the fact that the adults can fly and so can be taken on the wing apparently recommends them to birds that take their food in the manner of flycatchers. The aggregate of this food for the year is 21.38 per cent, a somewhat larger showing than that of any other of the flycatchers under consideration. Two stomachs were entirely filled with caterpillars and in several others they exceeded 90 per cent. As practically all caterpillars are harmful it is evident that this bird is doing a good work.

Dragon flies, lace-winged flies, and a few other odd insects make up 4.14 per cent. Dragon flies were found in 18 stomachs, which is a large record, for such agile insects can be taken only by very active birds. Spiders were found in 47 stomachs, and while these creatures are eaten frequently but in small quantites, 1 stomach was filled with them, and in another they amounted to 77 per cent of the contents. Altogether they amount to 4.03 per cent of the food. Three stomachs contained the bones of a lizard (*Anolis carolinensis*). These, with a few eggshells, make up 0.74 per cent and complete the animal food.

Following is a list of the animal food identified in the stomachs:

HYMENOPTERA (bees and wasps).

Limneria sp	1	*Tiphia inornata*	1
Ophion bilineata	1	*Myzine* sp	1
Ophion sp	1	*Chrysis* sp	2
Glypta rufiscutellaris	1	*Halictus* sp	1
Ephialtes sp	1	*Nomada* sp	1
Ichneumon sp	1	*Bombus* sp	1
Camponotus pennsylvanica	1	*Apis mellifera*	1
Camponotus sp	1		

COLEOPTERA (beetles).

Cicindela 6-guttata	1	*Cotalpa lanigera*	2
Agonoderus pallipes	1	*Euphoria sepulchralis*	1
Adalia bipunctata	1	*Euphoria inda*	9
Cucujus clavipes	1	*Elaphidion* sp	2
Hololepta fossularis	1	*Strangalia luteicornis*	1
Ips fasciata	3	*Typocerus zebratus*	4
Elater nigrinus	1	*Monohammus* sp	1
Melanotus communis	1	*Dorcaschema alternatum*	1
Melanotus sp	2	*Liopus variegatus*	1
Limonius griseus	1	*Œdionychis petaurista*	1
Limonius auripilis	1	*Colaspis brunnea*	1
Corymbites hieroglyphicus	2	*Nodonota* sp	1
Dicerca sp	1	*Gastroidea* sp	1
Pœcilonota cyanipes	1	*Odontota dorsalis*	2
Chauliognathus marginatus	1	*Coptocycla bicolor*	1
Phanæus carnifex	1	*Epitragus tomentosus*	1
Onthophagus hecate	1	*Meloe angusticollis*	1
Aphodius fimetarius	4	*Attelabus bipustulatus*	1
Trox sp	1	*Tanymecus lacæna*	1
Dichelonycha subvittata	2	*Artipus floridanus*	2
Dichelonycha elongata	1	*Anthonomus signatus*	1
Dichelonycha sp	4	*Anthonomus grandis*	2
Lachnosterna sp	2	*Læmosaccus plagiatus*	2
Anomala oblivia	1	*Conotrachelus nenuphar*	2
Anomala marginata	1	*Conotrachelus* sp	1
Anomala sp	1	*Balaninus* sp	6

DIPTERA (flies).

Syrphus sp	1	*Tabanus* sp	2

LEPIDOPTERA (butterflies, moths).

Nadata gibbosa	1	*Dryocampa rubicunda*	1

HEMIPTERA (bugs).

Sinea diadema	7	*Brochymena arborea*	5
Metapodius femoratus	1	*Smilia* sp	1
Nezara hilaris	5	*Ceresa bubala*	1
Nezara sp	1	*Thelia uhleri*	1
Euschistus sp	1		

ORTHOPTERA (grasshoppers and crickets).

Scudderia sp	1	*Tettix* sp	2

NEUROPTERA (lace-winged flies, etc.).

Chrysopa sp	2	*Mantispa* sp	1

VERTEBRATE.

Lizard (*Anolis carolinensis*)	3

Vegetable food.—The vegetable food consists of small fruits and a little rubbish. Thirteen different species of fruit were identified, but no one was eaten to a much greater extent than the others. Some fruit was eaten in every month except April, but more than half of all was taken in August, when it amounts to 16.62 per cent of the food of that month. For the year it aggregates 5.36 per cent. Rubbish is only 0.94 per cent and is probably accidental.

The following fruits were found in the stomachs:

Mulberry (*Morus* sp.)	3	Grape (*Vitis* sp.)	2
Pokeberry (*Phytolacca decandra*)	2	Rough-leaved cornel (*Cornus asperifolia*)	3
Sassafras (*Sassafras variifolium*)	2	Huckleberry (*Gaylussacia* sp.)	2
Spicebush (*Benzoin æstivale*)	1	Blueberry (*Vaccinium* sp.)	4
Blackberry and raspberry (*Rubus* sp.)	3	Elderberry (*Sambucus canadensis*)	2
Chokecherry (*Prunus virginiana*)	2	Fruit not further identified	3
Wild bird cherry (*Prunus pennsylvanica*)	2		
Virginia creeper (*Psedera quinquefolia*)	1		

Summary.—From the foregoing it is evident that the crested flycatcher does little if any harm. It is a very desirable bird to have about the orchard or garden, since it does not attack any cultivated crop. As its natural nesting site is a cavity in a partially decayed tree, it can probably be induced to nest in properly constructed boxes, if such are placed in the orchard or other suitable situations. Thus it can be induced to live in orchards and woodland not now frequented by it because of the lack of nesting sites, and eventually no doubt a substantial increase in its numbers can be effected.

ASH-THROATED FLYCATCHER.

(*Myiarchus cinerascens.*)

The ash-throated flycatcher occupies the western part of the United States from the Pacific Ocean as far east as Texas and Colorado and as far north as Washington and Utah. Like the kingbirds, it is a bird of the open parklike country, and is particularly partial to the vicinity of abandoned ranches, in the buildings of which it is pleased to build its nest, while it forages in the orchard and about the deserted garden and cattle yards. Normally it builds in natural cavities in trees and in the abandoned holes of woodpeckers.

For the determination of the character of this bird's food only 91 stomachs were available, taken in the months from April to December, inclusive. So few, spread over so long a time, can give only a tentative idea of the food. In the first analysis the food divides itself into 92.32 per cent of animal matter to 7.68 of vegetable. Of the animal portion all but a few spiders is made up of insects, strictly speaking. Some fruits and seeds compose the vegetable part.

Animal food.—The ash-throat is one of the lesser beetle eaters among the flycatchers. Beetles aggregate only 7.26 per cent of the food, and of these 2.15 per cent can be considered as of useful species. These last consist of predaceous ground beetles (Carabidæ), found in 3 stomachs, and a ladybird (Coccinellidæ) in 1. The bird evidently does not hunt for these insects, or it would find more of them. Other beetles belonging to 7 different families were found in 60 stomachs, or two-thirds of the whole number. This raises the question as to the criterion for the palatableness of any article of food—the frequency with which the bird takes it or the amount eaten. Hymenoptera amount to 26.94 per cent and are the largest item of animal food. Wild bees and wasps make up the bulk of this item, with a few of the parasitic species. No honeybees were found. That Hymenoptera are a favorite food is shown by the quantity eaten and by the facts that they were found in 55 stomachs and that they were well distributed over the season.

Hemiptera (bugs) amount to 20.11 per cent, which is the highest record for this item among the flycatchers now considered. Among them were many of those queer beechnut-shaped little bugs commonly known as buffalo tree hoppers (Membracidæ). These creatures are as agile as fleas, and would seem to be too nimble to be taken by most species of birds, but the ash-throat is evidently very successful in catching them, as they were found in 23 stomachs, while the sluggish stinkbugs (Pentatomidæ) were in only 13. Cicadas were found in 13 stomachs, jumping plant lice (Psyllidæ) in 7, leaf hoppers (Jassidæ) in 7, shield bugs (Scutelleridæ) in 1, assassin bugs (Reduviidæ) in 1, and negro bugs (Corimelænidæ) in 1. They were all taken in the 5 months from April to August, inclusive, and the average per month, if those 5 alone be considered, is 36.19 per cent.

Diptera (flies) amount to 12.83 per cent of the food, and were eaten in every month except August and September, but this exception is probably accidental. Those identified belong to the house-fly family (Muscidæ), the Syrphidæ (*Eristalis tenax*), and the robber flies (Asilidæ). These last were found in 2 stomachs only. Altogether Diptera were found in 24 stomachs. Lepidoptera (moths and their larvæ) were eaten in all the months but 3 (August, September, and October), but this is probably only accidental. A greater number of stomachs might show a regular consumption throughout the season. They amount to 17.11 per cent of the seasonal diet and were found in 29 stomachs. Of these, 22 contained caterpillars and 7 moths. No special pest was identified.

Orthoptera (grasshoppers and crickets) were eaten in the 4 months, April to July, and a few in December. The total is only 5.14 per cent, and the maximum, 18.07 per cent, occurs in July. Raphidians, dragon flies, and spiders together make 2.93 per cent, the balance of the animal food. The first-named are queer, long-necked, grotesque-looking creatures found in this country only in the far West. They are carnivorous in their habits and are said to prey upon the codling moth. In any event, they do not appear to be numerous in this country at present, and the only specimens the writer ever collected were in the stomachs of birds. The ash-throat appears to eat more of them than any bird yet examined, as they were found in 10 stomachs. One stomach contained 5, and in all there were 16 individuals. Dragon flies were found in 6 stomachs, about the usual proportion for a flycatcher, and spiders in 17, a rather large showing for such sedentary creatures.

Vegetable food.—The vegetable food of the ash-throat may all be summed up in two words, fruit and seeds. Elderberries (Sambucus) were found in 5 stomachs, cissus in 1, black nightshade (Solanum) in 1, fruit not identified in 2, and seeds unknown in 3.

Food of nestlings.—Besides the examination of the stomachs of the ash-throated flycatcher some observations were made on the feeding of nestlings. A nest of 4 young, about a week old when first observed, was watched in hour periods for several days, and the results are given in tabular form below.

Date.	First and last feeding during hour.	Number of feedings.
1906.		
June 18	12.59 p. m.— 1.45 p. m.	9
22	10.48 a. m.—11.39 a. m.	14
22	2.07 p. m.— 3.07 p. m.	9
26	2.13 p. m.— 3.11 p. m.	18
26	5.56 p. m.— 6.21 p. m. (half hour).	7
1906.		
27	5.15 a. m.— 6.13 a. m.	28
27	11.27 a. m.—12.22 p. m.	9
27	4.47 p. m.— 5.26 p. m.	9
28	5.26 a. m.— 6.18 a. m.	16
		119

Average number of feedings per hour, 14. After the first hour's feeding on the morning of June 27, the mother bird was accidentally shot, but the father carried on the feeding to a successful issue, and the young left the nest about noon on the 28th.

Summary.—In its animal food the ash-throat destroys a great number of harmful insects and a few beneficial ones, so that the balance is greatly in the bird's favor. Its vegetable food has absolutely no economic interest.

PHŒBE.

(*Sayornis phœbe.*)

There are but few birds in the United States more endeared to the rural and village population than the common phœbe (Pl. IV). Its habit of associating itself with man and his works, its trustful disposition, and the fact that it is never seen to prey upon any product of husbandry have rendered it almost sacred. It is distributed over the eastern United States as far west as central Texas, northern New Mexico, and Nebraska, and extends north into British America, where it spreads farther west than it does in the United States. It breeds in the whole of this region except the southern parts of the Gulf States. It spends the winter in the Gulf States and beyond our southern boundary. It is not generally a bird of the forest, but lives about farms and gardens, where it chooses a nesting site in crannies of buildings or walls, under bridges, in quarries, or in other similar sheltered places. As the bird is very partial to the vicinity of water, a bridge naturally becomes a favorite nesting place, and from this habit it is often spoken of as the "bridge phœbe." As the phœbe is in such close association with man and spends a large portion of the year in fields and gardens, it follows that its food is likely to be of considerable economic interest. For its investigation 370 stomachs were available, collected in 19 States, the District of Columbia, and Canada. They represent every month in the year and are fairly well distributed.

The food was found to consist of 89.23 per cent of animal matter to 10.77 of vegetable. The animal portion is composed of insects, with some spiders and myriapods, a gordius, and one bone of a tree frog. The vegetable part is made up of small fruits or berries, with a few seeds, all of them probably of wild species.

Animal food.—Useful beetles, consisting of tiger beetles (Cicindelidæ), predaceous ground beetles (Carabidæ), and ladybirds (Coccinellidæ), amount to 2.68 per cent. Other beetles, belonging to 21 families that were identified, make up 12.65 per cent. They appear to be eaten very regularly in every month, but the most are taken in spring and early summer. May is the month of maximum consumption with 23.67 per cent. Beetles altogether amount to

15.33 per cent, which places them as second in rank of the items of animal food. The notorious cotton-boll weevil (*Anthonomus grandis*) was found in 6 stomachs taken in the cotton fields of Texas and Louisiana, and 5 individuals of the strawberry weevil (*A. signatus*) were taken from one collected in Texas. Many of the other beetles contained in the stomachs are by nature equally harmful, but are not so widely known. Such are the corn leaf-beetle (*Myochrous denticollis*), which feeds upon corn; also the 12-spotted cucumber beetle (*Diabrotica 12-punctata*) and the striped cucumber beetle (*D. vittata*), both of which seriously injure and sometimes destroy cucumber and squash vines. The locust leaf miner (*Odontota dorsalis*) has been referred to before. It is sometimes so numerous that all the locust trees over large areas are blasted as by fire.

In the phœbe's diet Hymenoptera stand at the head, as is the case with most of the flycatchers. They are eaten with great regularity and are the largest item in nearly every month. A few of them are the useful parasitic species, which are, however, offset by quite a number of sawfly larvæ, which are very harmful insects. Ants, which are a nuisance, were found in 24 stomachs. No honeybees were identified, but testimony has been received to the effect that the phœbe sometimes eats bees. The following is from a letter written to the Biological Survey by Mr. S. J. Walcott, and dated at Waverly, N. Y., November 30, 1891:

> Having an apiary attached to our place, have often watched common phœbe birds gorge themselves to repletion with honeybees and in two minutes eject the entire mass through the mouth and again resume business with their former relish, and continue this practice for a long time, thereby weakening and sometimes entirely annihilating healthy colonies of bees.

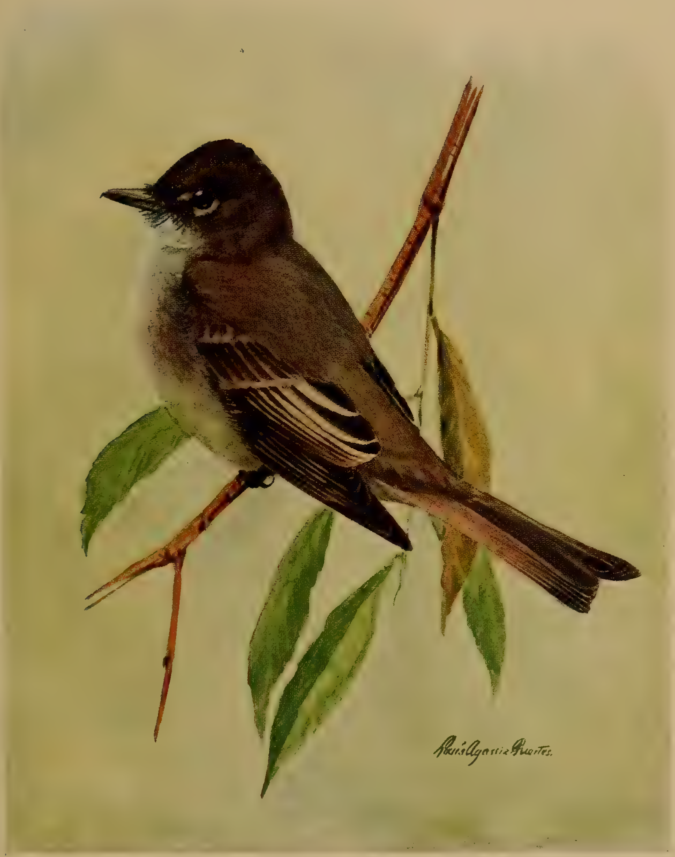
The maximum amount of Hymenoptera was taken in August, when they aggregated 39.66 per cent. They constituted the entire contents of 7 stomachs, and were found altogether in 225, which would seem to establish these insects as the favorite food of the phœbe. In bulk they amount to 26.69 per cent of the yearly diet.

Diptera aggregate 6.89 per cent, and are a very constant, though small, element of the food. The maximum occurs in June, when they amount to 17.90 per cent. The minimum of 1.40 per cent comes in December, when, as is well known, flies are not very abundant. The long-legged crane flies (Tipulidæ), a few horseflies (Tabanidæ), some house flies (Muscidæ), and several other families make up this item. They were found in 79 stomachs and although they do not appear to be very appetizing, they constituted the entire contents of 3 stomachs. Hemiptera (bugs) seem to be sought for rather more than flies, as they were found in 151 stomachs, but only 1 was entirely filled with them. Very curiously these were leaf hoppers (Jassidæ), lively little creatures that live on grass and leaves and jump like fleas. In all, 16 families were represented in the stomachs, but stinkbugs (Pentatomidæ) take the lead, being found in 42. Bugs are most sought by this bird in the winter months, probably because in summer other and more appetizing insects can be obtained. Half of all that were eaten were taken from November to February, inclusive, but a fair percentage was found in the stomachs of every month. The average for the year is 10.38 per cent.

Orthoptera (grasshoppers and crickets) form 12.91 per cent of the phœbe's food, but are eaten very irregularly, and while found in the stomachs of every month they vary greatly from one month to the next, and are found in the greatest amount when least expected. January is the month which shows the highest consumption, 24.19 per cent, while July is practically the same, 24.15 per cent. August, which with most eastern birds is the great month for eating grasshoppers, in this case shows only 6.37 per cent, while in June only 1.50 per cent were taken. There is no apparent logical reason for this irregularity. It is probably an accident, and a larger amount of material would almost surely give a more even result. Grasshoppers were found in 125 stomachs, crickets in 23, and locusts in 6, which would seem to indicate a reasonable fondness for this order of insect. The only kind that was specifically identified was the red-legged grasshopper (*Melanopus femur-rubrum*), a well-known and very destructive insect.

Lepidoptera (moths and caterpillars) are eaten much more regularly than grasshoppers, but not in such large quantities. They amount to 8.86 per cent of the food of the year, and were found in 118 stomachs, of which 47 contained adult moths and 71 held caterpillars. One stomach was entirely filled with a large moth. June, with 14.90 per cent, was the month of greatest consumption, but all the months show a fair percentage and none of them fall greatly below the average. A few miscellaneous insects, such as dragon flies, caddis flies, and ephemerids, amount to 2.39 per cent, and while not eaten extensively were taken to some degree in every month.

Spiders constitute quite a steady article of the phœbe's diet. Ticks and millepeds also are eaten. None of these creatures can be taken when they are on the wing, as they can not fly, but spiders may sometimes be picked up when they are sailing through the air upheld by their gossamer threads or they may be found on the top of a tall reed as the bird flies past. But ticks and millepeds must be taken from the ground or some other surface. The aggregate of these creatures for the year is 5.78 per cent. March is the month of greatest consumption with 11.94 per cent, but April stands nearly as high, while every month shows a fair percentage except June, which has but 1 per cent. Spiders were found in 76 stomachs, millepeds in 7,


Louis Agassiz Fuertes.

PHOEBE

wood ticks (*Ixodes scapularis*) in 2, and a cattle tick (*Margaropus annulatus*) in 1. Maj. Bendire says:

> Dr. Ralph tells me that in Florida the phœbe frequently alights on the backs of cattle and follows them around, catching the flies on these animals and fluttering above them in search of insects.[1]

This may possibly explain the presence in the stomachs of such unlooked-for creatures as ticks. The stomachs from which the ticks were taken were collected in Florida.

The following animal food was identified in the stomachs:

HYMENOPTERA.

Megachile sp	1	*Camponotus pennsylvanicus*	3
Andrena sp	2	*Ichneumon* sp	1
Halictus sp	4	*Cryptus* sp	4
Crabro sp	1	*Mesostenus* sp	1
Vespa maculata	1	*Ophion* sp	2
Chrysis sp	1	*Campoplex* sp	1
Myzine sp	3	*Limnerum* sp	1
Myrmica scabrinodis	1	*Paniscus* sp	1
Aphænogaster sp	3	*Exetastes* sp	1

COLEOPTERA.

Cicindela 6-guttata	1	*Chauliognathus pennsylvanicus*	1
Cicindela 16-punctata	1	*Chauliognathus marginatus*	4
Cicindela repanda	1	*Telephorus bilineatus*	1
Pterostichus sp	1	*Collops 4-maculatus*	1
Amara exarata	1	*Canthon lævis*	1
Amara sp	1	*Canthon viridis*	2
Platynus 4-dentatus	1	*Copris minuta*	2
Platynus sp	2	*Onthophagus hecate*	5
Chlænius sp	1	*Onthophagus tuberculifrons*	1
Anisodactylus rusticus	2	*Onthophagus pennsylvanicus*	4
Anisodactylus sp	2	*Onthophagus* sp	4
Hydroporus undulatus	1	*Atænius imbricatus*	1
Hydrophilus glaber	1	*Atænius cylindrus*	2
Megilla maculata	3	*Aphodius fimetarius*	19
Hippodamia convergens	1	*Aphodius granarius*	1
Coccinella 9-notata	3	*Aphodius inquinatus*	19
Adalia bipunctata	2	*Aphodius bicolor*	1
Anatis 15-punctata	5	*Aphodius* sp	8
Hister depurator	1	*Dichelonycha* sp	1
Ips fasciatus	3	*Macrodactylus subspinosus*	1
Cytilus sericeus	1	*Diplotaxis* sp	3
Drasterius elegans	2	*Lachnosterna* sp	1
Dolopius marginatus	1	*Valgus caniliculatus*	1
Melanotus sp	1	*Phymatodes* sp	1
Limonius griseus	1	*Liopus* sp	1
Limonius quercinus	1	*Pogonocherus* sp	1
Chrysobothris sp	1	*Orsodachna atra*	2

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[1] Life Histories of North American Birds, II, p. 273, 1895.

Lema trilineata	2	*Phyxelis rigidus*	1
Chlamys plicata	2	*Cercopeus chrysorrhœus*	1
Crytocephalus venustus	1	*Tanymecus lacæna*	1
Myochrous denticollis	2	*Macrops* sp	1
Diabrotica 12-punctata	3	*Anthonomus signatus*	1
Diabrotica vittata	1	*Anthonomus grandis*	6
Galerucella sp	3	*Conotrachelus posticatus*	1
Blepharida rhois	1	*Chalcodermus* sp	1
Disonycha caroliniana	2	*Acalles carinatus*	1
Odontota dorsalis	1	*Rhinoncus pyrrhopus*	1
Odontota sp	2	*Balaninus victoriensis*	1
Chelymorpha cribraria	1	*Balaninus* sp	7
Blapstinus sp	1	*Sphenophorus compressirostris*	1
Tricrania sanguinipennis	1	*Sphenophorus* sp	2
Negalius marmoratus	1	*Rhodobænus 13-punctatus*	1
Epicauta pennsylvanica	1		

DIPTERA.

Scatophaga stercoraria	1	*Eristalis* sp	1

HEMIPTERA.

Cicada sp	2	*Metapodius femoratus*	1
Oncometopia undata	1	*Myodocha serripes*	1
Aulacizes irrorata	1	*Nabis subcoleoptratus*	2
Aulacizes lateralis	1	*Sinea diadema*	5
Tettigonia sp	1	*Milyas cinctus*	1
Euschistus sp	1	*Hygrotrechus* sp	4
Brochymena sp	1		

ORTHOPTERA.

Melanoplus femur-rubrum	1	*Tettix* sp	10

ODONATA.

Agrion sp	1

ACARINA.

Ixodes scapularis	2	*Margaropus annulatus*	1

Vegetable food.—The vegetable food of the phœbe may be placed in two categories, fruit and seeds. Fruit amounts to 4.99 per cent. In May and June, the months of strawberries and cherries, no fruit at all was taken. In July 1 per cent was eaten, and from this point it increases slowly to December and January, with 10.73 and 10.84 per cent, respectively. The only thing found suggestive of cultivated fruit was the seeds of blackberries or raspberries contained in 5 stomachs. Of small wild berries 17 species were identified, besides a number of seeds, but nothing of any economic value was found. There were several species of seeds, but the only ones of interest were the poison ivy and poison sumac, whose seeds the birds distribute, but they were found in only a few stomachs. The great bulk of the vegetable food was taken in the fall, winter, and early spring months.

The following fruit, seeds, etc., were identified in stomachs of the phœbe:

Juniper (*Juniperus virginiana*)	1
Panic grass (*Panicum* sp.)	1
Greenbrier (*Smilax bona-nox*)	2
Bayberry (*Myrica carolinensis*)	15
Wax myrtle (*Myrica cerifera*)	4
Mississippi hackberry (*Celtis mississippiensis*)	1
Western hackberry (*Celtis occidentalis*)	2
Smartweed (*Polygonum* sp.)	1
Pokeberry (*Phytolacca decandra*)	4
Carolina moonseed (*Cocculus carolinus*)	1
Fever bush (*Benzoin benzoin*)	1
Sassafras (*Sassafras variifolium*)	2
Shadbush (*Amelanchier canadensis*)	2
Blackberry or raspberry (*Rubus* sp.)	5
Wild black cherry (*Prunus serotina*)	2
Cassia (*Cassia* sp.)	1
Dwarf sumac (*Rhus copallina*)	1
Smooth sumac (*Rhus glabra*)	2
Poison ivy (*Rhus toxicodendron*)	12
Poison sumac (*Rhus vernix*)	1
Sumac sp. (*Rhus* sp.)	20
Dahoon holly (*Ilex cassine*)	2
Virginia creeper (*Psedera quinquefolia*)	1
Rough-leaved dogwood (*Cornus asperifolia*)	2
Blueberry (*Vaccinium* sp.)	3
Persimmon (*Diospyros virginiana*)	1
Horse sugar (*Symplocos tinctoria*)	1
Virginia plantain (*Plantago virginica*)	1
Arrowwood (*Viburnum dentatum*)	1
Elderberry (*Sambucus* sp.)	4
Ragweed (*Ambrosia* sp.)	1
Fruit not further identified	22

Food of nestlings.—Among the stomachs examined were those of four newly hatched nestlings, which merit passing notice. The stomachs contained no vegetable matter whatever, but were completely filled with insects and spiders. The largest item was young grasshoppers, which constituted 63.75 per cent of the contents of the four stomachs. Next to these were spiders, which amount to 14.25 per cent. Flies, partly in the shape of grubs or maggots, came next with 9.75 per cent. Hymenoptera (wasps) amount to 5.25 per cent; caterpillars, to 4.50; two beetles, one adult the other larval, to 1.75; and parts of a bug and a moth, to 0.75. Note the soft character of the food. The grasshoppers were all young, partly grown, and very soft bodied. The spiders and caterpillars also were soft, the Hymenoptera were somewhat harder, but the only really hard food was the one adult beetle.

Summary.—It seems hardly necessary to say anything in favor of a bird already firmly established in the affections of the people, but it may not be amiss to point out that this good will rests on a solid foundation of scientific truth. In the animal food of the phœbe there is such a small percentage of useful elements that they may be safely overlooked; while of the vegetable food it may be said that the products of husbandry are conspicuous by their absence. Let the phœbe remain just where it is. Let it occupy the orchard, the garden, the dooryard, and build its nest in the barn, the carriage house, or the shed. It pays ample rent for its accommodations.

SAY'S PHŒBE.

(*Sayornis sayus.*)

Say's phœbe is an inhabitant of western North America from the Pacific Ocean eastward as far as western Texas, Kansas, and Nebraska, and extends northward into Alaska. In the warmer southwestern portions of the country it usually migrates northward, or else goes up into the hills or mountains in the breeding season. For this reason it is not often seen in the valleys in California during the summer. It is a bird mostly of the open, though sometimes taken in timber country. After the season of reproduction the pairs apparently separate, and each alone is engaged in its perpetual hunt for insects. It is domestic in its tastes, and in California, when it returns from its summer range, it is apt to attach itself to some house or other building and remain in that immediate vicinity all winter, roosting at night in a cranny under the cornice or wherever it can find snug, covered quarters.

For the determination of this bird's food, 111 stomachs were taken, representing every month of the year, but while too few to give exact results, they will probably fix the bird's economic status with a reasonable degree of accuracy. In the first analysis the food was found to consist of 99.78 per cent of animal food to 0.22 per cent of vegetable.

Animal food.—Beetles of the three most useful families—Cicindelidæ, Carabidæ, and Coccinellidæ—amount to 5.95 per cent of the food. This is a surprisingly large percentage to be eaten by a flycatcher. They were found in every month except May and July, and these months would no doubt have shown some had there been more stomachs. They were found in 5, 26, and 15 stomachs, respectively; that is to say, the greatest flyers, the cicindelids, which one would suppose to be the most easily taken by a flycatcher, are chosen the least, and the coccinellids, which live on trees and fly sluggishly, are taken less than the carabids, that live almost wholly upon the ground. Other beetles amount to 9.72 per cent, and are either harmful or neutral species.

Hymenoptera are the largest item of food, and with a greater number of stomachs would undoubtedly hold that rank in every month. We have, however, only two stomachs taken in May and one in July, and these contain no Hymenoptera at all. In all the other months there is a good percentage, and the average for the year is 30.72 per cent. They are mostly bees and wasps, with a few ants. No honeybees were found.

Hemiptera are eaten very irregularly and in small quantities. The total amounts to 4.45 per cent. Five families were represented, but the stinkbugs (Pentatomidæ) were contained in the most stomachs.

Diptera (flies) appear to be more popular than bugs with Say's phœbe. The aggregate is 16.67 per cent, while for the eight months in which they were eaten the average amount is 25 per cent. The kinds eaten are mostly of the families of the house fly, the crane fly, and the robber fly. One stomach was entirely filled with members of the house-fly family (Muscidæ).

Caterpillars and moths amount to 12.12 per cent of the diet of Say's phœbe. Here for the first time is found a flycatcher that eats more of the adults (moths) than it does of the larvæ (caterpillars). The former were found in 19 stomachs and the latter in 17. None were in the stomachs of July and August, but as only three stomachs were collected in those months, the record can not be accepted as final. Most of the other months show a fair percentage, and May and June appear to be the months of greatest consumption. Grasshoppers and crickets seem to be well liked, as they occurred in 48 stomachs, were the total contents of one, and amount to 15.36 per cent of the food. They are probably eaten in every month, but none were found in the few stomachs taken in January, June, and July. The average for the nine months in which they occur is over 20 per cent. Dragon flies, spiders, millepeds, and a few sowbugs, together amount to 4.79 per cent of the food, and make up the remainder of the animal quota.

The following animal food was identified in the stomachs:

COLEOPTERA.

Cicindela lemniscata	1	*Euphoria inda*	1
Dyschirius gibbipennis	1	*Leptura instabilis*	1
Amara interstitialis	2	*Gastroidea* sp	1
Amara sp	1	*Œdionychis miniata*	1
Anisodactylus rusticus	1	*Haltica foliacea*	1
Hippodamia convergens	2	*Blapstinus* sp	3
Coccinella californica	3	*Epicauta stuarti*	1
Hister ulkei	1	*Thecesternus humeralis*	1
Collops argutus	8	*Mylacus saccatus*	1
Aphodius inquinatus	3	*Sitones* sp	1
Aphodius sp	2		

DIPTERA.

Cyrtopogon bimacula	1	*Lucilia* sp	1
Cynomyia cadaverina	1		

ORTHOPTERA.

Melanoplus sp	2

CRUSTACEA.

Oniscus sp	1

Vegetable food.—The vegetable food of Say's phœbe can be dismissed with a few words. It consists of seeds of elder (Sambucus) contained in 3 stomachs, nightshade (Solanum) in 2, a single seed of a fig in 1, seeds of tarweed (Madia) in 1, and rubbish in 4. Thus it has no economic importance.

The following fruits were identified:

Elderberry (*Sambucus glauca*)	3	Black nightshade (*Solanum nigrum*)	2
Tarweed (*Madia sativa*)	1	Fig (*Ficus*)	1

Summary.—It is evident that the animal food is the factor that fixes this bird's economic position. The item of this most open to criticism is the three families of predatory beetles. This item is higher with Say's phœbe than with any other of the flycatchers, but still is small as compared with the injurious insects eaten. It is evident that in spite of the fact that the bird eats these useful insects its work on the whole is beneficial, and it should be protected.

BLACK PHŒBE.

(*Sayornis nigricans.*)

The black phœbe (Pl. V) would seem to have extended its range from Mexico into the United States along the southern border and on the west coast. In California it is confined chiefly to the region west of the Sierra Nevada, and its range extends for a short distance into Oregon. Farther south it is found east as far as central Texas. It inhabits the valleys and is resident throughout the year. Like many other flycatchers, it is very partial to the vicinity of water, and every stream or pool, and even the watering trough by the roadside, will be found to have its attendant phœbe. It is as domestic as its eastern relative, and habitually builds its nest under the eaves or in crannies of buildings, and where these are surrounded by a large stockyard with a plentiful supply of water the conditions appear to be ideal. Bridges, overhanging banks of streams, and rock cliffs also are favorite nesting sites.

While camping beside a stream in California the writer observed the feeding habits of the black phœbe. The nesting season was over, and apparently the birds had nothing to do but look for food, and this they appeared to do all the time. At the first gleam of daylight a phœbe could always be seen flitting from rock to rock, and probably it caught an insect on each flight. This activity was kept up all day, and even after supper, when it was so dark that notes could be written only by the light of the camp fire, the phœbes were still hunting insects. Up and down this stream there was a phœbe at every 10 or 12 rods patrolling for insects.

Observations like these are convincing evidence that the number of insects destroyed in a year by this species is enormous, and the examination of stomachs confirms field observations. But few flycatchers, or birds of any kind, devour a larger percentage of insect food than the black phœbe. It is not at all improbable that this species and many others seldom or never take vegetable food intentionally. In many cases the vegetable substance found in the stomachs is mere rubbish accidentally picked up with insects. Bees and wasps often light on berries to suck the juice, and a bird making a quick snap at such an insect might take berry and all, and when the seeds were found in its stomach it might be charged with having intentionally eaten the fruit.

For the laboratory investigation of this bird's food 344 stomachs were available, all but one collected in California, but distributed through every month of the year. The food was found to consist of 99.41 per cent of animal matter to 0.59 per cent of vegetable.

Animal food.—Useful beetles belonging to the three families Cicindelidæ, Carabidæ, and Coccinellidæ were found in 15 stomachs and amount to 2.82 per cent of the food. Other beetles of harmful or neutral species were found in 41 stomachs and reach 10.50 per cent. Hymenoptera form the largest item of the food. They were found in 247 stomachs and were the whole contents of 15. There is a good percentage in every month except March and April, and these exceptions are probably accidental. As would naturally be expected, the greatest amount is eaten in August, when it aggregates 58.75 per cent of the food. The average for the year is 30.82 per cent. A few parasitic species were noted, but they were too few to make a respectable percentage. Ants were found in 48 stomachs, and for a short time in midsummer constitute quite a notable part of the food. Various wild bees and wasps make up the bulk of this item. No honeybees were found.

Hemiptera, or bugs in various forms, constitute 10.56 per cent and were found in the stomachs of every month but May. December is the month of greatest consumption and April and May of least. They were found in 92 stomachs, and 13 families were identified. Pentatomidæ, or stinkbugs, appear to be the favorites, as they were contained in 10 stomachs, the most of any family. Plant lice (Aphidæ) were found in 1 stomach. Diptera, or flies, amount to 28.26 per cent and form the second largest item. They were found in 97 stomachs and completely filled 3. They constitute the most regular article in the black phœbe's diet. Every month has a good percentage, except perhaps August, which shows only 4.92, but the next one is July, with 11.47, and all the others are higher. The maximum occurs in April at 64.36 per cent. The black phœbe fairly merits its title of flycatcher.

Lepidoptera (moths and caterpillars) amount to 8.22 per cent of the food. They were found in 72 stomachs, of which 51 contained the adult moths and 28 the larvæ or caterpillars. One stomach was entirely filled with the adults. This is one of the few birds studied by the writer that eats more moths than caterpillars, for as a rule the caterpillars are largely in excess. Naturally the flycatchers, taking their food upon the wing, would prove exceptions to the rule. Grasshoppers and crickets are evidently not a favorite food of the black phœbe, as they amount to only 2.45 per cent. They were found in 39 stomachs, but usually the amount in each was small, though 1 stomach was entirely filled with them. They were taken in the months from June to October, with a small percentage in February and April. Dragon flies, white ants (Termes), a few unrecognizable fragments of insects, and spiders amount to 5.78 per cent, the balance of the animal food. Dragon flies were found in 63 stomachs, or 18 per cent of the whole—the largest record for these insects yet noted. The wonder is that they do not amount to a greater percentage.

The following insects were identified:

COLEOPTERA.

Elaphrus riparius	1
Triæna longula	2
Bradycellus rupestris	1
Tropisternus sp	1
Laccobius ellipticus	1
Philonthus pubes	1
Hippodamia convergens	7
Hippodamia ambigua	1
Coccinella californica	2
Chilocorus orbus	1
Cryptorhopalum apicale	1
Hister bimaculatus	1
Saprinus obscurus	1
Saprinus lugens	2
Saprinus lubricus	2
Saprinus fimbriatus	1
Carpophilus hemipterus	1
Heterocerus tristis	1
Canthon sp	1
Onthophagus sp	2
Aphodius fimetarius	1
Aphodius granarius	1
Aphodius vittatus	2
Aphodius ungulatus	1
Aphodius sp	6
Amphicoma ursina	2
Gastroïdea sp	1
Lina scripta	1
Diabrotica soror	2
Blapstinus pulverulentus	2
Blapstinus sp	4
Corphyra sp	1
Notoxus alamedæ	1

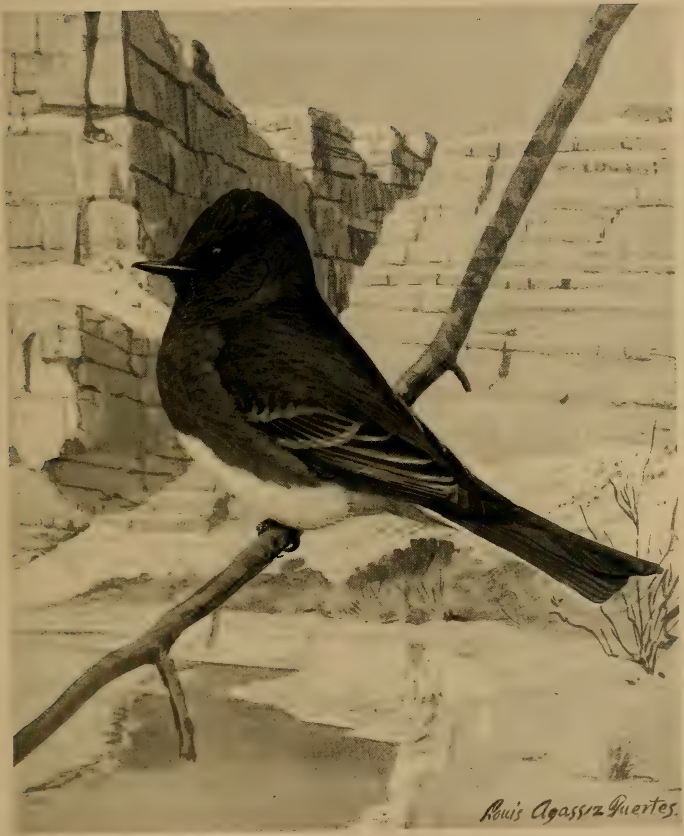
HEMIPTERA.

Largus succinctus	1

Vegetable food.—Seeds of elderberries were found in 16 stomachs and were probably taken intentionally. Seeds of Rubus (blackberry or raspberry) were found in 1 stomach, seed of dogwood (Cornus) in 1, 1 seed of poison oak in each of 3 stomachs, seed of filaree in 1, seeds unknown in 5, fruit pulp in 1, catkin in 1, and rubbish in 6. It all amounts to 0.59 per cent, and certainly has little economic interest.

The following fruits and seeds were identified:

Elderberry (*Sambucus glauca*)	16
Dogwood (*Cornus pubescens*)	1
Filaree (*Erodium* sp.)	1
Raspberry or blackberry (*Rubus* sp).	1
Poison oak (*Rhus diversiloba*)	3


Louis Agassiz Fuertes.

BLACK PHOEBE.

Food of nestlings.—Among the stomachs involved in the foregoing discussion are those of 22 nestlings varying in age from 1 to 2 weeks. These were separately tabulated, and show some differences from the diet of the adults. The food consisted of 98.86 per cent of animal matter to 1.14 of vegetable. This is apparently more than twice as much vegetable matter as was taken by the adults, but nearly all of it was rubbish, probably given to the young accidentally. Only 1 stomach contained a little fruit pulp—real food. Beetles, which are hard food, amount to 3.14 per cent. Hymenoptera, which are softer and much more easily crushed and broken up, aggregate 44.68 per cent. Hemiptera (bugs) were fed to 1 nestling only. It was 17 per cent of that stomach's contents, but amounts to only 0.77 per cent of the whole food. Diptera, which are softer than Hymenoptera, were fed to the amount of 34.73 per cent. In 1 brood of 3 the average in each stomach was 75 per cent, and in another brood of 3 the average was 82 per cent. In 2 other broods none at all were found. Lepidoptera reached a percentage of 8.23 per cent, but were irregularly distributed; that is, they were fed to only 6 of the 22 birds, but to an average extent of over 30 per cent to each. Crickets were fed to but 1 of the nestlings, but in that 1 they amounted to 85 per cent, making an average of 3.86 per cent for all. Dragon flies were fed to 3 birds of different broods to the extent of 10, 15, and 30 per cent, respectively. The average for the 22 is 2.50 per cent. It will be noted that the nestlings' food is on the whole composed of much softer constituents than that eaten by the adults. If we take the three softest elements—Hymenoptera, Diptera, and Lepidoptera—we find that they aggregate 87.64 per cent of the whole food.

Summary.—While the black phœbe does not improve every opportunity to destroy harmful insects, it certainly neglects many chances to eat useful ones. The destruction of a few predaceous beetles, dragon flies, and parasitic Hymenoptera are the sum of its sinning. So far as the writer knows, this bird is welcomed and protected everywhere throughout its range, which is as it should be.

OLIVE-SIDED FLYCATCHER.

(*Nuttallornis borealis.*)

The olive-sided flycatcher appears to be an inhabitant of North America at large, but is nowhere very abundant. It breeds in scattered localities throughout the United States; in the southern part only in the mountains. It shows a decided preference for mountainous regions and coniferous forests; consequently it is not often seen about orchards and gardens and does not usually come in contact with crops. Interest in its food, therefore, is to a certain degree academic. Its food habits, however, are notable from the fact that this species represents the extreme of the flycatcher type. Of the

17 species treated in this bulletin Hymenoptera form the largest item in the stomachs of 13, and may therefore be considered as the typical food of flycatchers. In the consumption of Hymenoptera the olive-sided stands at the head. Nevertheless, Maj. Bendire, in speaking of this bird, says:

> Like all flycatchers, their food consists almost exclusively of winged insects, such as beetles, butterflies, moths, and the numerous gadflies which abound in the places frequented by these birds.[1]

Examination of the stomachs of this species shows that the 3 orders specially referred to amount to less than 12 per cent of its food—another instance of the incompleteness of field observation upon the diet of birds.

In the investigation of this bird's food 69 stomachs were collected in 12 States, Ontario, Nova Scotia, and New Brunswick during the months from April to September. They are distributed across the continent from New Brunswick to Washington, and as far south as Texas. In the first analysis the food was found to consist of 99.95 per cent of animal food and 0.05 per cent of vegetable. This minute portion of vegetable matter is of so little importance that it may be disposed of at once. It consists of fruit pulp, not further identified, to the amount of 3 per cent, and some spruce foliage and other rubbish, all found in 1 stomach collected in Colorado in the month of July. The two latter items amount to 1 per cent, and may both be properly classed as rubbish, probably swallowed accidentally.

Animal food.—Useful beetles were found in 3 stomachs and amounted to 0.45 per cent of the food. They consisted of 1 tiger beetle (Cicindelidæ) and 2 predaceous ground beetles (Carabidæ) and were found in the 3 months of May, July, and August. Beetles belonging to harmful families were found in the diet of every month and amounted to 5.79 per cent of the food. Among these beetles were 2 specimens of the cotton-boll weevil (*Anthonomus grandis*) from the stomach of a bird taken near a cotton field in Texas. Hymenoptera are the staff of life of the olive-sided flycatcher and form a large percentage of the food of each month. The fewest were taken in May, when they amounted to 74.50 per cent. The average consumption for the season from April to September was 82.56 per cent. They were found in 61 of the 63 stomachs, and 26, that is, over 41 per cent of the whole, contained no other food. Of all the birds examined by the Biological Survey, not one subsists so nearly exclusively upon one order of insects. Winged ants were found in 10 stomachs and entirely filled 2 of them. A few useful parasitic species were identified, but more interesting than these were 63 honeybees (*Apis mellifera*), found in 16 stomachs, or 25 per cent of the whole number. Of these, 36 were workers and 27 were males or drones. Thus the bird shows a very decided fondness for hive bees, but not the special preference for drones manifested by kingbirds. Five stomachs taken near an apiary at Riverside, Cal., contained 25 honeybees, or an average of 5 to each stomach, and 2 stomachs contained nothing else. In 1 of these were 8 workers and in the other 4 drones. Altogether in the 5 stomachs there were 16 drones and 9 workers, a number which seems to indicate that where bees are abundant the bird selects drones. From this record it appears that the olive-sided flycatcher would be a menace to the bee-keeping industry were it abundant in the thickly settled portions of the country.

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[1] Life Histories of North American Birds, II, p. 284, 1895.

Diptera (flies) were found in 3 stomachs in July and 1 in September. The amount for the season (April to September) is 0.88 per cent. Hemiptera (bugs) were eaten in May and June and to a less extent in July and August. The average for the season is 3.25 per cent, all contained in 5 stomachs. Stinkbugs, cicadas, and tree hoppers were the only families identified. Grasshoppers in the diet of this bird were found in only 2 stomachs, 1 taken in May and 1 in July. They constitute 3.36 per cent of the food of the 2 months, or 1.12 per cent for the whole season of 6 months.

Lepidoptera, in the shape of moths, were found in 5 stomachs, and entirely filled 2 of them. They were all taken in the 3 months of June, July, and August, and amount to 4.13 per cent of the food for the season. All of them were adult moths and no trace of a caterpillar was found in any stomach. This presents the extreme case where the adults are eaten to the complete exclusion of the larvæ, but it is evident that Lepidoptera are not a favorite food with the olive-side. Dragon flies were found in 4 stomachs collected in August and September. They amount to 1.77 per cent and complete the quota of animal food.

The following is a list of the insects identified in the stomachs:

HYMENOPTERA.

Apis mellifera	16	*Vespa maculata*	3
Bombus virginicus	1	*Tiphia inornata*	1
Bombus sp	1	*Camponotus pennsylvanicus*	1
Xylocopa virginica	1	*Ichneumon* sp	1

COLEOPTERA.

Amara californica	1	*Aphodius* sp	1
Elater behrensi	1	*Dichelonycha* sp	1
Elater sp	1	*Euphoria sepulchralis*	1
Melanotus longulus	1	*Asemum mœstum*	1
Buprestis aurulenta	1	*Acmæops proteus*	1
Melanophila fulvoguttata	1	*Anthonomus grandis*	1
Onthophagus sp	1	*Balaninus* sp	1
Aphodius fimetarius	3	*Dendroctonus validus*	1

HEMIPTERA.

Cicada sp	2

Summary.—The most prominent fact in the food habits of the olive-sided flycatcher is its consumption of honeybees. As it eats no vegetable matter worth mentioning, its record must rest on its insect food, and honeybees constitute entirely too large a quota for the best economic interests. Were the bird as abundant and as domestic as either of the phœbes, there is no doubt that it would be a pest to bee keepers. At present it probably does little harm, except when, as in the case noted, a number of the birds take up their residence in the vicinity of the apiary and make bees a part of their regular diet.

The food of this bird is interesting, as it represents the food of a typical flycatcher. With the exception of the vegetable matter in 1 stomach, everything it eats could be taken on the wing. Caterpillars, spiders, and millepeds, although found in the stomachs of most flycatchers, are entirely absent.

WOOD PEWEE.

(*Myiochanes virens.*)

During the breeding season the wood pewee inhabits the eastern part of the United States, from central Texas, Kansas, Nebraska, and the Dakotas; its breeding range also extends northward into Canada. In winter it retires southward far beyond the boundaries of the United States and returns north rather late in spring, though 2 stomachs used in this investigation were taken at Bloomington, Ill., on the 5th and 27th, respectively, of March.

It makes its home both in dense forests and in open groves, and in New England, at least, is a frequenter of orchards to such a degree that it has there received the name of orchard phœbe. Although it does not build in hollow trees, it seems to prefer an orchard of old trees, probably because insects are more abundant there. In thickly settled regions it is quite domestic and sometimes lives and nests in village shade trees and forages about gardens.

The bird is well known as a fairly typical flycatcher, but it eats some food that can not be taken on the wing. In writing of this bird Maj. Bendire says:

> Mr. George A. Seagle, superintendent of the Wytheville (Va.) Fish Commission Station, states: "This little bird has frequently been seen to catch young trout from the ponds soon after they had been transferred from the hatching house." [1]

Catching fish is a singular occupation for a flycatcher, and doubtless is highly exceptional. Nothing was found in the stomachs examined indicative of any such food habit. Nevertheless in the stomachs of several other flycatchers the bones of tree frogs and lizards have been noted, so that the case does not appear at all improbable.

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[1] Life Histories of North American Birds, II, p. 289, 1895.

The following discussion of the food of the wood pewee is based upon the examination of 359 stomachs taken in 20 States of the Union, the District of Columbia, Ontario, New Brunswick, and Nova Scotia. They were collected in the months from March to October and are well distributed over that time.

The food was found to consist of 98.97 per cent of animal matter to 1.03 of vegetable. The animal food is made up of insects, spiders, and millepeds; the vegetable, of berries and seeds.

Animal food.—Carabidæ and Coccinellidæ, or ground beetles and ladybirds, amount to 3.62 per cent of the food, and this is probably too high, for only 2 stomachs were taken in March, and 1 of these was nearly half full of these beetles, and therefore raised the average for the whole season of eight months. Other beetles constitute 10.61 per cent of the food, and include, among others, such harmful species as the clover-leaf weevil (*Phytonomus punctatus*), the plum curculio (*Conotrachelus nenuphar*), the corn weevil (*Sphenophorus zeæ*), and the rice weevil (*Calandra oryzæ*), besides 6 species of the Scolytidæ, a family which includes some of the worst enemies of forest trees. Between 30 and 40 of these tree destroyers were found in 1 stomach. Beetles belonging to at least 27 families were eaten. They were contained in 220 stomachs and in 5 there was no other food.

Hymenoptera constitute 28.20 per cent of the food, and are eaten largely in every month except March, when only 2 somewhat exceptional stomachs were taken; in fact, were this month omitted, the percentage for the season would rise to 32.15, which is probably much nearer the truth. As has been before observed, the flycatchers take a considerable number of useful parasitic species among the Hymenoptera which they eat. The wood pewee is probably the worst sinner of the family in this respect. In midsummer these useful insects constitute a very considerable proportion of the hymenopterous food and in June amount to about one-third of it. It is safe to say that about one-fourth of the Hymenoptera eaten by the wood pewee are of parasitic species. This, however, is probably not so great a fault as may at first appear, and does not necessarily condemn the bird. Two worker honeybees were identified, 1 in each of 2 stomachs. Hymenoptera were found in 261 stomachs, and 10 stomachs contained nothing else.

Diptera amount to 29.98 per cent of the seasonal diet and are the most regular and constant constituent of the food. A very considerable percentage is eaten in every month, and in September, which is the month of least consumption, Diptera still amount to 15 per cent. In May they aggregate 44.47 per cent, a figure that may be considered as fairly reliable, for 83 stomachs were collected in that month. Diptera were found in 190 stomachs and were the sole contents of 22. Among others, there were recognized the horseflies

(Tabanidæ), the robber flies (Asilidæ), the syrphus flies (Syrphidæ), the tachina flies (Tachinidæ), and a number of long-legged crane flies (Tipulidæ). The great bulk of the dipterous food, however, belonged to the house fly family (Muscidæ). The syrphus and tachina flies are useful insects, but the great majority of members of the fly families are a nuisance and many of them pests, and it is a benefit to the world to have their numbers reduced; in this respect the wood pewee is doing a good work.

Moths and caterpillars (Lepidoptera) are eaten by the wood pewee every month of its stay in the north, but not quite so regularly nor in such quantities as flies. The average for the season of eight months is 12.31 per cent. They were found in 79 stomachs, but no stomach was entirely filled with them. The adult moths were found in 59 stomachs, and the larvæ, or caterpillars, in 21—another instance where the moths eaten much exceed the caterpillars. Owing to their soft bodies none of these insects were well enough preserved to enable the species to be recognized, but, as nearly the whole order is composed of harmful species, identification is not necessary.

Orthoptera (grasshoppers and crickets) are eaten very sparingly and irregularly by the wood pewee. The total for the season (March to October) is 3.44 per cent. They were found in only 33 stomachs, and but 1 contained no other food. These insects are perhaps too large to be successfully managed by so small a bird; moreover, they are not extensive flyers, and some of them do not fly at all, which probably accounts for their rarity in the diet.

Hemiptera (bugs) are eaten in every month of the pewee's stay north, but in small and rather irregular quantities. They were found in 98 stomachs, and not one was completely filled with this kind of food. The families recognized were the tree hoppers (Membracidæ), leaf hoppers (Jassidæ), negro bugs (Corimelænidæ), stinkbugs (Pentatomidæ), squash bug family (Coridæ), assassin bugs (Reduviidæ), and water striders (Hydrobatidæ). All of these are harmful in their habits except the assassin bugs, which destroy caterpillars and other insects, and the water striders, which have no economic significance. The amount for the season is 5.99 per cent of the food.

Miscellaneous insects, nearly all of which are dragon flies, were eaten with remarkable regularity in all the months from May to September. The total for the season is 2.61 per cent. Spiders, with a few millepeds, were taken in every month of the pewee's stay in the north, but rather irregularly. They are probably eaten as makeshifts when better food is wanting, as on rainy days when flying insects are not abroad. They amount to 2.21 per cent of the food, and complete the animal quota.

The following is a list of the insects identified and the number of stomachs in which each was found.

HYMENOPTERA.

Apis mellifera	2
Melissodes sp	1
Andrena sp	1
Halictus sp	1
Crabro sp	1
Odynerus sp	1
Chrysis cœruleans	1
Tiphia inornata	5
Aphænogaster fulvum	1
Camponotus pennsylvanicus	3
Camponotus sp	2
Proctotrypes sp	1
Pteromalus sp	1
Ichneumon sp	1
Hemiteles sp	1
Mesostenus sp	2
Ophion bilineatum	1
Agathis sp	1
Bracon sp	1
Tremex sericeus	1

COLEOPTERA.

Elaphrus sp	1
Clivina striatopunctata	1
Amara impuncticollis	1
Platynus sp	1
Stenolophus fuliginosus	1
Tachycellus atrimedius	1
Anisodactylus baltimorensis	1
Dineutes emarginatus	1
Aleochara bimaculata	1
Philonthus longicornis	1
Scaphidium 4-maculatum	1
Megilla maculata	1
Coccinella sanguinea	2
Adalia bipunctata	1
Anatis 15-punctata	1
Psyllobora 20-maculata	1
Chilocorus bivulnerus	1
Hyperaspis undulata	1
Hyperaspis gemina	1
Hister subrotundus	2
Hister sp	1
Platysoma lecontei	1
Saprinus sphæroides	2
Ips fasciatus	25
Drasterius dorsalis	1
Chrysobothris pusilla	1
Agrilus arcuatus	1
Agrilus bilineatus	1
Agrilus sp	2
Plateros sp	1
Chauliognathus pennsylvanicus	10
Chauliognathus marginatus	2
Chauliognathus americanus	1
Chauliognathus sp	2
Podabrus frater	1
Clerus 4-guttatus	1
Thanasimus dubius	1
Canthon lecontei	1
Onthophagus hecate	1
Onthophagus pennsylvanicus	2
Onthophagus sp	9
Atænius sp	1
Aphodius fimetarius	20
Aphodius ruricola	1
Aphodius inquinatus	9
Aphodius granarius	1
Aphodius bicolor	1
Aphodius sp	6
Dichelonycha elongata	2
Dichelonycha sp	5
Euphoria inda	1
Typocerus velutinus	1
Strangalia luteicornis	1
Leptura rubrica	1
Goes debilis	1
Hæmonia nigricornis	1
Anomæa laticlavia	1
Cryptocephalus guttulatus	1
Colaspis sp	1
Diabrotica 12-punctata	5
Diabrotica vittata	1
Diabrotica longicornis	1
Systena frontalis	1
Odontota dorsalis	4
Odontota rubra	1
Odontota nervosa	1
Odontota quadrata	1
Cassida bivittata	1
Haplandrus femoratus	1
Androchirus fuscipes	1
Mordella serval	1
Mordella sp	1
Attelabus nigripes	1
Sitones hispidulus	1
Phytonomus punctatus	2
Læmosaccus plagiatus	2
Conotrachelus nenuphar	2
Conotrachelus seniculus	1

Cryptorynchus lapathi	1	*Sphenophorus* sp	1
Piazurus oculatus	2	*Calandra oryzæ*	1
Piazurus operculatus	1	*Platypus flavicornis*	3
Cœliodes acephalus	1	*Tomicus calligraphus*	1
Rhinoncus pyrrhopus	2	*Tomicus pini*	1
Baris striata	2	*Tomicus avulsus*	1
Balaninus sp	15	*Tomicus grandicollis*	2
Sphenophorus zeæ	2	*Scolytus 4-spinosus*	2

DIPTERA.

Chrysops sp	2	*Lucilia cæsar*	1
Tabanus sp	2	*Sapromyza vulgaris*	1
Syrphus sp	1		

HEMIPTERA.

Ceresa sp	1	*Euschistus* sp	1
Stictocephala sp	1	*Nezara hilaris*	1
Stictopelta tripunctata	1	*Corizus lateralis*	1
Corimelæna pulicaria	1	*Sinea diadema*	3
Euschistus spinosus	1	*Hygrotrechus* sp	1

ORTHOPTERA.

Tettigidea sp	1	*Tettix* sp	4

Vegetable food.—The vegetable food consists entirely of a few berries and seeds. No trace of any product of cultivation was found, except possibly 2 seeds of raspberry or blackberry found in 1 stomach, but these were probably wild. The only possible criticism that can be made is that the bird may distribute a few poison-ivy seeds, for 1 seed of this noxious plant was found in 1 of the stomachs.

The following fruits and seeds were identified:

Elderberry (*Sambucus canadensis*)	2	Poison ivy (*Rhus toxicodendron*)	1
Blueberry (*Vaccinium* sp.)	1	Blackberry or raspberry (*Rubus* sp.)	1
Alternate-leaved dogwood (*Cornus alternifolia*)	1	Poke berry (*Phytolacca decandra*)	2
Rough-leaved dogwood (*Cornus asperifolia*)	1	Panic grass seed (*Panicum* sp.)	2

Food of nestlings.—Among the stomachs were those of 2 broods of nestlings, and these were separately considered to discover possible differences in diet. One brood of 2 was labeled "just hatched," and the food was found to consist of grasshoppers, 52.50 per cent; bugs (Hemiptera), 32.50; and spiders, 15 per cent. The other brood of 4 was simply designated as "nestlings," with no hint as to their age. Their food consisted of grasshoppers and crickets, 66.25 per cent; flies (Diptera), 12.50 per cent; caterpillars, 17.50; and spiders, 3.75 per cent. This food does not differ essentially from that of the adults, except that the softer elements have been selected. The grasshoppers were, many of them, immature, and they entirely filled one stomach.

Summary.—The one point most open for criticism in the food of the wood pewee is that it eats too many parasitic Hymenoptera. There is no doubt that all birds which prey upon Hymenoptera at all destroy some of the useful species, but the proportion in the food of this bird is greater than in other birds whose food has been investigated. As these insects are for the most part smaller than the more common wasps and bees, it would seem natural that they should be preyed upon most by the smaller flycatchers, which very likely accounts for the fact that the wood pewee eats more of them than the kingbirds. But even so the bird does far more good than harm. The loss of the useful Hymenoptera can be condoned when it is remembered that with them the bird takes so many harmful or annoying species.

WESTERN WOOD PEWEE.

(*Myiochanes richardsoni.*)

During the breeding season the western wood pewee ranges over the western portion of the United States from the Pacific coast eastward as far as the western part of Texas, Kansas, Nebraska, and the Dakotas, and north to Alaska. In its fall migration it passes entirely beyond the southern boundary of the United States. The bird is seldom found in the forest, but rather on the edge of woods and in groves and open park country. Since the introduction of fruit growing it has taken kindly to orchards and gardens, and frequently builds its nest in fruit trees. Like its eastern relative, *virens*, it builds in the open upon the branch of a tree, instead of in a hollow limb or under some overhanging projection, as do so many other flycatchers. Like *virens* it prefers an orchard or grove where insects abound and the trees offer a number of dead twigs to serve as lookouts from which to sally forth to catch insects.

The writer once observed a pewee flying forth for insects from one of these perches, and noted the number caught in three minutes. In the first minute 7 were taken, in the second 5, and in the third 6, or 18 in three minutes. These observations were made at 10 a. m., when the air was warm and many insects were on the wing. At 9 a. m. the next day the same perch was again watched, and 17 captures were noted in 8 minutes. This morning was much cooler than the previous one and fewer insects were abroad. The mean of these two observations is 4 insects per minute, and if this rate is kept up for even 10 hours a day, the total is 2,400 insects. It seems hardly possible that one bird can eat so many unless they are very small, but this bird is rarely seen when it is not hunting. When there are young in the nest to feed, the havoc among the insects of that immediate vicinity must be something enormous.

The western wood pewee remains on its northern range only about six months in the year, but fortunately that is the season when insects are most numerous, and the number that are annually destroyed by this species alone is almost beyond calculation.

In the investigation of this bird's diet there were 174 stomachs available for study. They were collected in 8 States, though most of them were taken in California, and are fairly well distributed over the six months from April to September. The food is made up of 99.93 per cent of animal matter and 0.07 per cent of vegetable.

Animal food.—Beetles, in the food of the western wood pewee, amount to 5.44 per cent, and were contained in 73 stomachs. Of these, ladybird beetles (Coccinellidæ) are 0.26 per cent, and predaceous ground beetles (Carabidæ) are 0.69 per cent, or in all, 0.95 per cent; that is, less than 1 per cent of useful beetles. The rest belong to harmful families, though no special pest was noted.

Hymenoptera (wasps and bees) are evidently very inviting food for the pewee. They are eaten in every month of the bird's stay north and a goodly quantity in each. They amount to 39.81 per cent of the food of the season (April to September), and were found in 107 stomachs, of which 17 contained no other food. Parasitic species were noted in 8 stomachs and ants in 10. No trace of a honeybee was found. Maj. Bendire quotes Mr. F. Stevens as saying of this species:

> I have known apiarists to be compelled to shoot a great many to protect their bees; one in San Diego County told me that he shot several hundred in a season. They capture both workers and drones, and I have examined many stomachs which had stings sticking in them.[1]

It would seem that conditions must have been very exceptional to cause such a destruction of honeybees, for the writer has never yet heard any complaints against the bird on this score and the stomachs contain no honeybees.

Diptera (flies) are the largest item of this pewee's food. They are eaten in every month of the bird's stay in the north and form a high percentage in all but one. They amount to 44.25 per cent of the food, which is the highest record for this item in the food of any one of the 17 flycatchers under consideration. This bird is well entitled to the name, for it certainly does catch flies, and 30 of the 162 stomachs were entirely filled with them. They were so much broken that species could not be recognized, but five families were distinguished. These were the horseflies (Tabanidæ), the snipe flies (Leptidæ), the crane flies (Tipulidæ), the robber flies (Asilidæ), and the house flies (Muscidæ). Diptera and Hymenoptera together constitute 84.06 per cent of the western pewee's food.

Hemiptera (bugs) are apparently not to the taste of this pewee. They were eaten only in the months from June to September, and amounted to but 1.79 per cent of the food. They were contained in 39 stomachs, and consisted of such families as stinkbugs, leaf hoppers, tree hoppers, and negro bugs, with probably others indeterminable.

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[1] Life Histories of North American Birds, II, p. 292, 1895.

Orthoptera (grasshoppers and crickets) are conspicuously absent from the food of this bird. Not a trace of this order of insects was found in any of the stomachs. This is the more remarkable as grasshoppers are one of the staple articles of diet with a large number of insectivorous birds, and western flycatchers in general eat more of these insects than most other fly-catching species.

Lepidoptera (moths and caterpillars) are eaten to a somewhat greater extent than Hemiptera, though contained in a less number of stomachs, 29. They were taken in every month of the season and amounted to 5.17 per cent. Moths were found in 24 stomachs and caterpillars in 5. Dragon flies (Raphidia), lace-winged flies (Chrysopidæ), May flies (Ephemerida), white ants (Termes), and spiders, including one of the bristly jointed spiders (Solpugida), together make 3.47 per cent, and complete the quota of animal food.

The following are the insects identified in the food and the number of stomachs in which each was found:

HYMENOPTERA.

Tiphia inornata	1

COLEOPTERA.

Hippodamia ambigua	1	*Agrilus* sp	1
Hippodamia convergens	1	*Ptilinus basilis*	1
Hippodamia transverso-guttata	1	*Canthon* sp	1
Coccinella 9-notata var. *nevadica*	1	*Aphodius vittatus*	1
Coccinella californica	1	*Aphodius* sp	1
Coccinella sanguinea	1	*Gastroidea* sp	1
Hister bimaculatus	1	*Blapstinus* sp	1
Saprinus plenus	1	*Baris rubripes*	1
Carphophilus hemipterus	1	*Balaninus* sp	1
Agriotes sp	1		

ISOPTERA.

Termes sp	1

NEUROPTERA.

Raphidia sp	3	*Chrysopa* sp	1

Vegetable food.—Vegetable matter, called by courtesy food, was found in 4 stomachs. In one of these it consisted of 3 seeds of elderberries (Sambucus); in another, of a bit of fruit skin, with a trifle of rubbish; in another, of one seed of wild oats; and in the fourth, of rotten wood. It may be possible that this bird occasionally eats a little fruit, but evidently not often.

Summary.—While the western pewee inhabits orchards, it does not go there for fruit, but only in search of the insect enemies of the trees. It eats but few useful insects, and does not, as far as this investigation shows, attack any product of industry. If, under exceptional circumstances, it destroys honeybees, the occasions are so rare that the bird should not be blacklisted.

YELLOW-BELLIED FLYCATCHER.

(*Empidonax flaviventris.*)

The yellow-bellied flycatcher inhabits the northeastern United States and Eastern British America in the breeding season, but in migration occurs over most of the country east of the Rocky Mountains. It is a lover of cool, shady forests and mountains and is probably the most retiring and shy of the flycatchers. Its nest is usually built in a damp mossy crevice of rocks or on the ground, or among the upturned roots of a fallen tree, but always in a retired place and is carefully concealed. Living apart from man and his works, it does not come into contact with the farmer's crops nor his bees, so its food, like the bird itself, is interesting chiefly to the bird student.

For the study of this bird's food only 103 stomachs were available. They were collected in 11 States, the District of Columbia, Ontario, New Brunswick, and Nova Scotia. They were taken as far southwest as Texas and as far northwest as Wisconsin. They are fairly well distributed over the five months from May to September. The food was found to consist of 97.01 per cent of animal matter to 2.99 of vegetable, or practically of 97 to 3. Insects and spiders make up the animal food and small fruit and seeds the vegetable.

Animal food.—In the animal food, beetles amount to 16.53 per cent. Of these the useful species aggregate 1.91 per cent and consist of a few Carabidæ and Coccinellidæ. Most of the others are harmful, while some are neutral. Beetles were found in 65 stomachs and were eaten pretty regularly in every month. *Diabrotica vittata*, the striped squash beetle, which is such a pest on squash, cucumber, and melon vines, was found in 8 stomachs, and snout beetles, or weevils, were noted in 25. All of these are more or less injurious. In 10 stomachs were identified weevils of the genus *Balaninus*, which lay in nuts of various kinds their eggs from which are hatched those fat white grubs so common in chestnuts.

Hymenoptera amount to 46.25 per cent of the food and were found in 81 stomachs. Of these, 48 contained ants, which amounted to 13.42 per cent of the whole. Parasitic species were noted in 9 stomachs, and they made up 2.12 per cent of the contents. Hymenoptera as a whole form the largest item of food in every month. This bird is probably the greatest eater of ants of any of the flycatchers and stands near the head in the eating of Hymenoptera in general.

Hemiptera were found in 33 stomachs only, and amount to 4.16 per cent of the food. Stinkbugs were found in 9 stomachs and assassin bugs in 12, of which 10 contained a single species (*Sinea diadema*) with as many as 6 in 1 stomach. The assassin bugs, like the stinkbugs, prey upon other insects, and so are to a certain extent useful insects, but *Sinea diadema* is said to have the bad habit of preying upon honeybees when near the hive. The yellow-bellied flycatcher does not select its bugs with the same good judgment that it shows when taking beetles, wasps, etc. Leaf hoppers and tree hoppers were the other families observed.

Diptera were contained in only 29 stomachs, but amounted to 14.89 per cent, or three and a half times as much as Hemiptera, although found in fewer stomachs. They belonged to several families, including the house fly, horsefly, and the long-legged crane fly. They were eaten in every month, but June and July showed the greatest consumption.

Lepidoptera were found in 28 stomachs, of which 4 contained the adult moths and 24 their larvæ or caterpillars. The amount for the season was 5.68 per cent. In one stomach was found a cricket's jaw, in another parts of a locust, and in a third some remains that were doubtfully referred to Orthoptera, and these were all the material found that could be assigned to Orthoptera. As the percentage was very small, it was included in miscellaneous insects, which are made up of these with a few May flies and a little unidentifiable matter, in all 0.98 per cent.

Spiders are eaten by this bird to a greater extent than by any of the other flycatchers. They amount to 8.52 per cent of the food and are taken quite regularly through the season. Beginning with 2.21 per cent in May they gradually increase to 14.28 per cent in September. Hymenoptera alone stand higher in the food of that month. With the exception of certain nestlings no other species of bird yet studied shows so high a percentage of spiders in its food, though wrens and titmice and some warblers approach it. Probably many of these were caught from their webs in mid-air. They were found in 30 stomachs—just one-third of all. In 13 stomachs they consisted of those peculiar species called "harvestmen" (Phalangida), or perhaps more commonly known as "daddy longlegs." These must have been picked from the ground or some plant, as they spin no webs.

The following insects were identified:

HYMENOPTERA.

Halictus sp	4	*Camponotus* sp	3
Spilomena sp	1	*Formica fusca*	1
Cerceris sp	1	*Hemiteles* sp	2
Vespa maculata	1	*Cryptus* sp	1
Chrysis sp	1	*Thalessa* sp	1
Myzine 6-cincta	1	*Xylonomus* sp	1
Tiphia inornata	1	*Ophion* sp	2
Aphænogaster sp	1		

COLEOPTERA.

Platynus sp	1	*Dichelonycha* sp	1
Coptotomus interrogatus	1	*Anomala binotata*	1
Cryptopleurus vagans	1	*Paria aterrima*	1
Megilla maculata	1	*Paria* sp	1
Hippodamia 15-maculata	1	*Diabrotica vittata*	8
Coccinella 9-punctata	1	*Cerotoma trifurcata*	1
Coccinella abdominalis	1	*Galerucella decora*	1
Anatis 15-punctata	1	*Crepidodera helxines*	1
Chilocorus bivulnerus	1	*Crepidodera cucumeris*	1
Agrilus egenus	1	*Odontota* sp	1
Chauliognathus pennsylvanicus	1	*Sitones* sp	2
Podabrus punctata	1	*Conotrachelus elegans*	2
Telephorus fraxini	2	*Cnemogonus lecontei*	1
Telephorus carolinus	1	*Baris ærea*	1
Canthon viridis	1	*Madarus undulatus*	1
Onthophagus sp	2	*Balaninus uniformis*	2
Aphodius fimetarius	2	*Balaninus nasicus*	1
Aphodius inquinatus	1	*Balaninus* sp	7
Aphodius sp	3		

LEPIDOPTERA.

Apatura sp	1	*Tortrix* sp	1
Clisiocampa sp	1		

HEMIPTERA.

Euschistus sp	2	*Acholla multispinosa*	1
Sinea diadema	10		

Vegetable food.—The vegetable food consists of a few small fruits, none of which are of domestic varieties, a few seeds of poison ivy, some cedar foliage, some scales from a bud, and rubbish. The poison ivy is the only thing of any interest and that was found in only one stomach.

The following fruits and seeds were found in the stomachs:

Red cedar (*Juniperus virginiana*)	1	Dogwood (*Cornus* sp.)	1
Poke berry (*Phytolacca decandra*)	1	Blueberry (*Vaccinium* sp.)	1
Poison ivy (*Rhus toxicodendron*)	1	Fruit unidentified	7
Frost grape (*Vitis cordifolia*)	2	Cedar foliage	1
Rough-leaved dogwood (*Cornus asperifolia*)	1	Bud scales	1

Summary.—So retiring are its habits that the yellow-bellied flycatcher is seldom brought into contact with man, and hence its food can have only restricted economic interest. Its bill of fare includes insects of a number of species which are injurious to garden, orchard, or forest, as the striped squash beetle, several species of weevils, tent caterpillars, and leaf rollers.

THE WESTERN YELLOW-BELLIED FLYCATCHER.

(*Empidonax difficilis.*)

The western yellow-bellied flycatcher occupies the western part of the United States from the Pacific coast eastward as far as the eastern foothills of the Rockies and as far north as Alaska. It is found on its summer range about eight months of the year and in winter in Mexico. While somewhat partial to the recesses of the forests it takes kindly to the open, when other conditions suit, and since the advent of civilization it finds orchards quite to its mind as foraging grounds. Like the Richardson's pewee it prefers a bare dead twig for a perch, where it sits and watches for flying insects. Like all flycatchers it has keen eyesight, for it often sees and darts at an insect which is so far away as to be invisible to the human eye. The nest is built in various places, but usually in a covered site. A hollow tree, a bracket of a house porch, a beam under a bridge, a crevice among the roots of an overturned tree or under the overhanging banks of a stream are fair illustrations of its nesting sites.

No complaints have been lodged against this bird by the farmer or orchardist—in fact, it is too small to be able to do serious injury to farm crops, and if it ate fruit it could injure only a few of the smaller varieties. Nor has it been accused of eating honeybees, which are probably too large to serve as its prey.

For the study of the food of the western yellow-bellied flycatcher 157 stomachs were collected, mostly from California, with a few from other Western States. They were taken in the months from March to October and were very fairly distributed in time. The food was found to consist of 99.31 per cent of animal matter to 0.69 per cent of vegetable. The animal portion is made up of insects with a few spiders, while the vegetable part consists of a few seeds and some rubbish.

Animal food.—Useful beetles amount to 2.45 per cent of the food, and consist of predaceous ground beetles (Carabidæ) found in 8 stomachs and ladybird beetles (Coccinellidæ) in 24 or 16 per cent of the whole number. This would seem to indicate that this bird has a decided taste for coccinellids, though the percentage is not large. As few other birds eat so many of these useful beetles, it is to be inferred that this species selects them intentionally. It must be understood that any bird that eats beetles in California is likely to get a large number of coccinellids, even if it takes indiscriminately all beetles that come in its way, for the family is wonderfully abundant in that State. Other beetles amount to 5.94 per cent and are eaten with considerable regularity through the season. The genus *Bala-*

ninus, the nut destroyer, was found in 8 stomachs, and several other harmful species were identified.

Hymenoptera amount to 38.76 per cent, and were found in 121 stomachs, of which 7 contained no other food. They were mostly wasps and bees, though ants were contained in 19 stomachs and one was entirely filled with them. But few parasitic species were found. This is the largest item of food and is eaten in considerable quantity in every month.

Hemiptera were eaten in the months from April to September quite regularly, but not in large quantities. They were found in 53 stomachs, of which 2 contained nothing else, and amount to 8.44 per cent of the food. The families identified were stinkbugs, tree hoppers, and leaf hoppers. The 2 stomachs that contained Hemiptera alone were entirely filled with stinkbugs.

Diptera are the second largest item of food and are eaten in every month and more regularly than any other. They were found in 67 stomachs and in 5 there was nothing else. They average 31.22 per cent of the seasonal food. Most of them were in such a state as to preclude specific identification, but a few were crane flies (Tipulidæ), one a horsefly (Tabanidæ), a few Tachina flies (Tachinidæ), and one a soldier fly (Stratiomyiidæ).

Lepidoptera were found in the food of every month except March, but in July and August in very small quantities only. They consisted of adult moths in 8 stomachs and caterpillars in 31. It is worthy of mention that larvæ of the codling moth (*Carpocapsa pomonella*) were found in 3 stomachs and were probably contained in a number more but unrecognizable. It is not improbable that some of the adult moths were of this species also, but too badly mashed for identification. In all, Lepidoptera amount to 6.59 per cent of the food, and are eaten in every month except March, July, and August.

Orthoptera were found in 2 stomachs taken in August and one in September. They amount to 0.62 per cent of the food. Raphidia and a few unidentified insects make up 0.71 per cent. Spiders were found in every month but March and were contained in 20 stomachs. They amount to 4.58 per cent and complete the animal food.

The following insects were identified:

HYMENOPTERA.

Chrysis sp	1

COLEOPTERA.

Anisodactylus piceus	1	*Lina scripta*	1
Philhydrus sp	1	*Diabrotica 12-punctata*	1
Aleochara bimaculata	1	*Diabrotica soror*	1
Hippodamia 5-signata	1	*Diabrotica* sp	1
Hippodamia ambigua	3	*Monoxia sordida*	1
Hippodamia convergens	4	*Haltica bimarginata*	1
Coccinella californica	6	*Haltica tombacina*	1
Scymnus sp	1	*Epitrix* sp	1
Limonius infuscatus	1	*Eulabis rufipes*	1
Telephorus divisus	1	*Blapstinus ruficeps*	1
Leptura soror	1	*Rhynchites glastinus*	1
Leptura crassipes	1	*Sitones* sp	1
Gastroidea cyanea	2	*Balaninus* sp	8
Gastroidea sp	3		

DIPTERA.

Stratiomyia maculosa	1	*Tabanus punctifer*	1

LEPIDOPTERA.

Carpocapsa pomonella	3

Vegetable food.—Vegetable matter was found in 19 stomachs, but not all of it can be called food. In 1 stomach were a few seeds of Rubus (blackberry or raspberry), in 8 were seeds of elderberries, in 2 were skins of fruit not further identified, in 1 a seed of tar weed (Madia), and in 7 were bits of rubbish. The Rubus fruit consisted of 2 seeds which may have been wild and in any case could have but little economic importance.

Food of nestlings.—Included in the 157 stomachs discussed in the foregoing pages were those of 9 nestlings. These were separately tabulated and were found to vary somewhat from the adults in the proportions of food elements. One brood of 4, thought to be about 48 hours old, had been fed upon beetles, 0.25 per cent; flies, 16.25 per cent; leaf hoppers, 39 per cent; raphidians, 1.75 per cent; caterpillars, 6.75 per cent; and spiders, 36 per cent. The soft character of this food is noticeable. A few bits of a beetle fed to one nestling constituted the only hard element. Not even wasps or ants were found. Another brood of 3, somewhat older than the last, had been fed upon beetles, 5.67 per cent; flies, 50.33 per cent; wasps, 24.67 per cent; caterpillars, 13.67 per cent; and spiders, 5.66. Here the hard elements have been increased by the greater amount of beetles and by the introduction of wasps. Two other nestlings, supposed to be about 10 days old, had been fed with wasps and bees to the extent of 92.50 per cent, with no other animal food. Besides these there was in one stomach what appeared to be a mass of rootlets amounting to 7.50 per cent, and both stomachs contained a few gravel stones. It is difficult to account for these last in the stomach of a flycatcher, but such strange objects are often found in nestlings' stomachs.

In a nest of these birds, built on a bracket in a porch of a house, the feeding of the young was watched for an hour. Both parents took part in the feeding, and the young were fed 24 times in the hour. As this was about the middle of the forenoon, it may fairly be considered as an average hour; at that time of year there were fully 14 hours of daylight, so it seems reasonable to infer that the nestlings were fed at least 336 times every day, or supposing that there were 3 of them, 112 times apiece. As the nest was situated in a garden and orchard, the insects eaten were taken from the very place where they would have done the most mischief.

ACADIAN FLYCATCHER.

(*Empidonax virescens.*)

The Acadian flycatcher breeds throughout the eastern portion of the United States as far north as southern New York, Michigan, and Wisconsin, and as far west as eastern Nebraska, Kansas, and Texas. It appears to extend farther north in the interior than it does in the east, for one stomach was received from Minnesota and one from Ontario. It winters beyond the southern boundary of this country. It is not domestic in its habits and prefers forests of deciduous trees to orchards or gardens. An area of second growth where the trees are not large seems to be the ideal place of residence.

For the study of its food 100 stomachs were available. They were collected in 14 States, the District of Columbia, and Canada, and from April to October. The food was found to consist of 97.05 per cent of animal matter and 2.95 per cent of vegetable.

Animal food.—Beetles are eaten to the extent of 13.76 per cent of the whole food. Of these 1.66 per cent are of the three prominently useful families (Carabidæ, Cicindelidæ, and Coccinellidæ). The others were of more or less harmful families and include such well-known pests as spotted cucumber beetle (*Diabrotica 12-punctata*), rose beetle (*Macrodactylus subspinosa*), rice weevil (*Calandra oryzæ*), and a scolytid. Beetles were found in 76 stomachs and were eaten quite regularly till October, when none were taken.

Wasps, bees, and ants amount to 39.93, or practically 40, per cent of the bird's food, and are eaten so regularly that no month's consumption falls much below the average. They were found in 76 stomachs, or 84 per cent of all, and 4 were entirely filled with them. Ants were contained in 29 stomachs and parasitic species in 13, but some of the latter may have been overlooked, owing to their broken condition. Hymenoptera as a whole are the largest item of animal food with this as well as most other flycatchers. Flies (Diptera) amount to

8.15 per cent of the food, and are not taken as regularly as Hymenoptera and in October are not eaten at all. They were noted in 39 stomachs and were the sole contents of 1. Most of them are of the housefly family, but a few long-legged crane flies were found in 5 stomachs. Bugs are eaten still less than flies. They amount to 6.03 per cent, but are not taken very regularly and not at all in October. They were contained in 29 stomachs and consisted of such families as the leaf hoppers, tree hoppers, stinkbugs, and assassin bugs.

Orthoptera were found in 1 stomach taken in Florida in April and 2 collected in Pennsylvania in September, but the percentage in each of these 3 stomachs was so great that the amount for the whole season is 6.38 per cent of the food, or more than the last item. The contents of the Florida stomach could not be determined further than that they were orthopterous, but the contents of the other 2 were identified as *Œcanthus niveus*, the snowy tree cricket, known in some places as the August bird. As these creatures are rather nocturnal in their habits and not much given to flying at any time, it is rather surprising to find that a flycatcher had nearly filled its stomach with them.

Moths, in both the adult and larval form (caterpillars), are second in importance in the animal food. They are taken pretty regularly in every month, but with some falling off in July. The amount for the whole season is 18.87 per cent. They were found in 38 stomachs, of which 31 contained caterpillars and 8 held moths; 3 contained no other food. No special pest was observed among them. A few miscellaneous insects, such as dragon flies, scorpion flies, and a few insects not identified, amount to 0.99 per cent, and have no special interest. Spiders and millepeds were eaten in moderate quantities from April to August. They amount to 2.94 per cent and complete the quota of animal food. As usual, many of them were the long-legged harvestmen or daddy longlegs.

The following insects were identified:

HYMENOPTERA.

Crabro sp	1	*Camponotus* sp	3
Cerceris sp	1	*Formica* sp	1
Myzine 6-cincta	1	*Cryptus* sp	2
Tiphia inornata	2		

COLEOPTERA.

Hippodamia 15-maculata	1	*Limonius plebejus*	1
Adalia bipunctata	1	*Anthaxia viridifrons*	1
Anatis 15-punctata	1	*Anthaxia* sp	1
Chilocorus bivulnerus	1	*Agrilus* sp	3
Brachycantha quadrillum	1	*Photinus scintillans*	1
Brachycantha ursina	1	*Chauliognathus pennsylvanicus*	1
Scymnus sp	1	*Chauliognathus marginatus*	1

Telephorus carolinus	1	*Diabrotica 12-punctata*	1
Chariessa pilosa	1	*Crepidodera helxenes*	2
Onthophagus sp	1	*Crepidodera* sp	1
Aphodius fimetarius	2	*Odontota dorsalis*	1
Aphodius inquinatus	1	*Odontota* sp	3
Dichelonycha sp	2	*Orchestes pallicornis*	1
Macrodactylus subspinosus	1	*Conotrachelus posticatus*	1
Trichius piger	1	*Cryptorhynchus parochus*	1
Leptura cordifera	1	*Cryptorhynchus apiculatus*	1
Lema 3-lineata	1	*Balaninus* sp	1
Exema conspersa	1	*Calandra oryzæ*	1
Paria sp	1	*Scolytus muticus*	1
Metachroma sp	1		

DIPTERA.

Lucilia cæsar	1

HEMIPTERA.

Euschistus sp	1

ORTHOPTERA.

Œcanthus niveus	2

MECOPTERA.

Panorpa sp	2

Vegetable food.—Fruit was found in 5 stomachs and vegetable refuse in 1. There were a few seeds of blackberries or raspberries, and these were the only things that could have been the product of cultivation. The rest was wild fruit of no economic value.

Summary.—The habits of the Acadian flycatcher do not lead it to the garden or orchard, and its food has little direct economic interest. It does not catch many useful insects and, as it does not prey upon any product of cultivation, it may well be considered as one of those species whose function is to help keep the great flood of insect life down to a level compatible with the best interests of other forms of life.

TRAILL'S AND ALDER FLYCATCHERS.

(*Empidonax traillii traillii* and *Empidonax traillii alnorum.*)

The Traill's and alder flycatchers, one or the other of the two forms, occupy in the breeding season the whole of the United States except the southeastern part south of northeastern Texas, Arkansas, and the mountains of West Virginia, and extend north into British America. In winter they retire entirely beyond the southern boundary of the United States. While the two subspecies differ in their geographical range, they agree with each other, and differ from most other flycatchers, in a preference for bushy thickets along streams rather than for more open country. Unlike most flycatchers they do not usually select a naked twig or stake for a perch, and the nest is generally built near the ground in bushes beside the water—in willows in the central and western portions of the country and in alders in the east. No special differences in the food habits have been noticed, and as many of the stomachs used in this investigation were collected before the two forms had been clearly distinguished, it is not practicable to separate them now.

In determining the food of this species there were available 135 stomachs collected in 17 States, the District of Columbia, New Brunswick, Nova Scotia, and Ontario. California represents the farthest point west and Texas the farthest south, but the Texas bird was probably migrating. The stomachs are well distributed through the months from May to September. One was taken in October, but as its contents were somewhat exceptional it was not included in the investigation.

In the first analysis the food was found to consist of 96.05 per cent of animal matter to 3.95 of vegetable. Nearly the whole of the vegetable food was taken in August and September, and more than three-fourths of it in the latter month, just previous to and during migration.

Animal food.—Beetles of all kinds amount to 17.89 per cent. Of these a few were the useful ladybird beetles that eat plant lice and scales, but an overwhelming majority were harmful species, among which were three specimens of the notorious cotton-boll weevil (*Anthonomus grandis*) from a stomach taken in Texas, also the western spotted cucumber beetle (*Diabrotica soror*), locust leaf miner (*Odontota dorsalis*), and *Lema trilineata*. The last was the beetle that fed upon and injured the potato before the introduction of the potato beetle from Colorado. Besides these are a number of harmful weevils, including 1 scolytid or engraver. Beetles were found in 108 stomachs, and 1 was entirely filled with them. They constitute a good percentage of the food in every month, with the least in September, when vegetable food is at a maximum.

Hymenoptera are the largest item of animal food, not only in the aggregate but in every month. They are mostly in the form of wasps and bees, but there are a few of the parasitic species and some ants. They amount to 41.37 per cent of the food, a record which is exceeded by but 2 other flycatchers. Hymenoptera of all kinds were found in 93 stomachs and were the sole contents of 1.

Diptera, such as crane flies, robber flies, house flies, and dung flies, were found in 47 stomachs and were the entire contents of 4. They amount to 14.20 per cent of the food and are eaten very regularly in every month except September, when they fall to 8.05 per cent.

Hemiptera, mostly stinkbugs, but with representatives of several other families, were contained in 44 stomachs, and amount to 7.24 per cent of the food. The most interesting point connected with this item is that the remains of chinch bugs (*Blissus leucopterus*) were found in 2 stomachs. In one 12 individuals were identified, and fragments showed that there were many more. In the other stomach they were too fragmentary to be counted, but the bulk of the remains would indicate at least as many.

Lepidoptera, that is moths and caterpillars, were found in 41 stomachs, of which 18 contained moths and 25 held caterpillars, 2 containing both. The aggregate of both is 7.73 per cent. No special pest was found among them, but practically all caterpillars are harmful.

Orthoptera, made up mostly of small grasshoppers of the genus *Tettix* and its allies and the immature forms of the larger species, amount to 3.91 per cent of the food. It is evident that most insects of this order are too large for such small birds as the present species. The fact that the smaller species of grasshoppers and partly grown young of the larger species are selected would seem to show that these insects are relished but that their size prevents them from being eaten more extensively. They were contained in 16 stomachs, 12 of which were taken in July and August, when most of the grasshopper eating was done.

A few odd insects, such as dragon flies and some ephemerids, were occasionally taken, and altogether amount to 2.77 per cent of the diet. A cattle tick was found in 1 stomach and a snail in another, both identifiable. Spiders and millepeds were eaten to the extent of 0.94 per cent and complete the animal food.

The following animal food was identified:

HYMENOPTERA.

Halticus sp	1
Agapostemon texanus	1

COLEOPTERA.

Cicindela sp	1
Megilla maculata	1
Hippodamia convergens	2
Hippodamia 13-punctata	1
Coccinella 9-notata	3
Adalia bipunctata	3
Psyllobora tædata	1
Brachycantha ursina	1
Languria mozardi	1
Dermestes caninus	1
Hister 16-striatus	3
Hister americanus	1
Saprinus lubricus	1
Ips fasciatus	3
Tharops ruficornis	1
Delopius marginatus	1
Limonius sp	1
Corymbites triundulatus	1
Agrilus sp	1
Brachys ovata	1
Chauliognathus marginatus	2
Podabrus sp	1
Telephorus fraxini	3
Telephorus flavipes	1
Telephorus bilineatus	3
Canthon simplex	1
Onthophagus sp	3
Aphodius fimetarius	9
Aphodius granarius	1
Aphodius inquinatus	2
Dichelonycha elongata	1
Dichelonycha sp	1
Diplotaxis sp	1
Euphoria inda	1

Dectes spinosus	1	*Crepidodera helxines*	1
Donacia subtilis	1	*Systena elongata*	1
Orsodachna atra	1	*Microrhopala dimidiata*	1
Lema trilineata	1	*Odontota dorsalis*	2
Cryptocephalus quadruplex	1	*Bruchus prosopis*	1
Cryptocephalus leucomelas	1	*Dircæa liturata*	1
Cryptocephalus venustus	1	*Pyrota schwarzii*	1
Cryptocephalus fulguratus	1	*Coleocerus marmoratus*	1
Pachybrachys abdominalis	1	*Sitones flavescens*	1
Monachus saponatus	1	*Dorytomus laticollis*	1
Glyptoscelis albidus	4	*Anthonomus grandis*	1
Diabrotica soror	1	*Tyloderma foveolatum*	1
Trirhabda tomentosa	1	*Rhinoncus pyrrhopus*	1
Galerucella sagittaria	1	*Pseudobaris farcta*	1
Blepharida rhois	1	*Scolytus muticus*	2
Disonycha melicollis	1		

DIPTERA.

Lestomyia sp	1

HEMIPTERA.

Tettigonia atropunctata	1	*Sinea diadema*	2
Blissus leucopterus	2		

ORTHOPTERA.

Tettix sp	2

ACARINA.

Dermacentor occidentalis	1

MOLLUSCA.

Pupa corticaria	1

Vegetable food.—The vegetable portion of the food amounts to but 3.95 per cent of the whole and was mostly eaten in September. Elderberries were found in 6 stomachs, blackberries or raspberries in 2, dogwood berries in 1, juniper berries in 1, fruit not further identified in 3, seeds unknown in 2, and rubbish in 1. The last two items were probably taken accidentally with other food.

The following fruits were identified:

Juniper berries (*Juniperus virginana*)	1	Rough-leaved dogwood (*Cornus asperifolia*)	1
Elderberries (*Sambucus canadensis*)	3	Blackberries or raspberries (*Rubus* sp.)	2
Elderberries (*Sambucus glauca*)	3		

Summary.—It is evident from the nesting habits of this species that it is not likely to injure any product of industry, and the contents of the stomachs examined corroborate this observation. The bird's function in nature then is to assist in keeping insects down to such a level of abundance as consists with the best interests of both plants and insects.

LEAST FLYCATCHER.

(*Empidonax minimus.*)

The least flycatcher is one of the smallest of the group and one of the most domestic, though, owing to its unobtrusive habits, it is not so well known as the noisier phœbes and kingbirds. In its breeding season it is found over the eastern portion of the United States and Canada as far west as the Rocky Mountains and in a few cases as far south as Texas and North Carolina. It frequents the open country and prefers orchards and the vicinity of buildings to thick woods. When not molested by the English sparrow, it finds congenial surroundings in villages and the suburbs of larger towns. Orchard trees, or the shade trees on lawns, afford nesting sites quite to its taste, for as a usual thing it does not build very high. It is a typical flycatcher in food habits, but like most others of the family it does not take all of its food upon the wing. The writer has seen one scrambling about on the trunk of a tree and catching insects from the bark like a creeper.

For the determination of the food of the least flycatcher 177 stomachs were available. They were collected from 13 States, the District of Columbia, Ontario, and Nova Scotia, and were taken within the months from April to September. They are fairly evenly distributed through the 6 months, but fewer were taken in April and more in May. The food consisted of 97.83 per cent of animal matter and 2.17 of vegetable.

Animal food.—Useful beetles, in this case mostly ladybird beetles (Coccinellidæ) with a few predaceous ground beetles (Carabidæ), amount to 1.41 per cent. They were eaten in every month except June, the most in September. Coccinellidæ appeared in 25 stomachs, only 3 families (Chrysomelidæ, Scarabæidæ, and weevils) being found in more and these not in many more. As this family is not especially abundant in the eastern part of the country, it is hard to explain how the bird gets so many unless it seeks for them. The aggregate in bulk does not appear large, but a good many individuals are taken, and 10 species were identified. Carabidæ were found in 13 stomachs. Beetles belonging to various families, but all harmful, amount to 19.94 per cent. Among these are some rather noted pests. The cotton-boll weevil (*Anthonomus grandis*) was found in 6 stomachs taken in Texas. In all, the stomachs contained 22 individual weevils. The striped squash beetle (*Diabrotica vittata*) and the 12-spotted cucumber beetle (*D. 12-punctata*) were both identified, as well as the imbricated clover weevil (*Epicærus imbricatus*) and the plum curculio (*Conotrachelus nenuphar*). All of these do much damage every year.

Hymenoptera are the largest item of insect food. They are eaten steadliy and regularly during every month in which stomachs were collected. April was the month of greatest consumption and June of the least. The average for the six months is 41.10 per cent. Hymenoptera of all kinds were found in 117 stomachs. Of these, 27 contained parasitic species and 42 contained ants. Three stomachs were entirely filled with ants and 4 with other Hymenoptera. Parasitic species were eaten to the average extent of 11.66 per cent per month, but were taken very irregularly, and in June none at all were eaten. This percentage is higher than is desirable and is probably due to the small size of the bird, which leads it to select small insects for its food.

Hemiptera are eaten throughout the season, but in widely varying quantities. Beginning with 4.67 per cent in April, they increase slightly in May, and rise suddenly to 32.74 per cent in June, after which they drop to nearly their former level and so continue through the season. The average for the six months is 11.12 per cent. While a few of the larger forms, like the Pentatomidæ, are eaten, the bulk of this item is made up of Membracidæ (tree hoppers), Jassidæ (leaf hoppers), with a few Capsidæ (leaf bugs), and others of the smaller species. Most of these are probably picked from leaves, trunks, and branches of trees, though a few may be taken on the wing.

Diptera amount to 11.34 per cent of the food and are eaten with considerable regularity from April till August, when they drop suddenly to 1.50 per cent. They rally a little in September, but evidently their season ends with July. Most of them were too badly mangled for further identification, but a few were crane flies (Tipulidæ).

Orthoptera are not extensively eaten by the least flycatchers, probably because they are rather large insects, and do not as a rule visit the flycatchers' haunts. Most that were eaten belong to the Tettix group or are the young of the larger species. They begin with a fraction of 1 per cent in May and increase to August, when they attain a maximum of 9.58 per cent and then disappear. The average for the season is 2.59 per cent.

Lepidoptera, in the forms of moths and caterpillars, are eaten in every month of the season. Beginning with 0.67 per cent in April they rise gradually to 10.97 in July and do not fall much below that figure during the remainder of the season. They were found in 47 stomachs, of which 21 contained the adult moths and 28 held caterpillars. Some of the caterpillars were identified as cutworms (Noctuidæ), but no special pest was noted. The average consumption for the season was 7.27 per cent. Ephemerids found in one stomach, dragon flies found in 3, and an unidentified insect in 1, make up 0.95 per cent. One stomach was entirely filled with a large dragon fly. Flycatchers are among the comparatively small number of birds expert enough to catch dragon flies on the wing, and these insects are too wary to be taken sitting. Spiders are eaten to a small extent in every month in the season. In June, which was the month of maximum consumption, they amounted to 6.26 per cent, and for the season they reached 2.11 per cent. These complete the animal food.

The following insects were identified:

HYMENOPTERA.

Tiphia inornata	1	*Ophion* sp.	1
Camponotus pennsylvanicus	2	*Chelonus* sp.	1

COLEOPTERA.

Agonoderus sp.	1	*Lina scripta*	1
Harpalus pennsylvanicus	1	*Gonioctena pallida*	1
Anisodactylus rusticus	1	*Diabrotica 12-punctata*	1
Anisodactylus baltimorensis	1	*Diabrotica balteata*	1
Cymbiodyta fimbriata	1	*Diabrotica vittata*	2
Hydrobius fuscipes	1	*Disonycha glabrata*	1
Hippodamia 15-maculata	1	*Disonycha* sp.	1
Hippodamia 13-punctata	1	*Haltica* sp.	1
Coccinella 9-notata	2	*Crepidodera helxines*	4
Coccinella sanguinea	1	*Crepidodera* sp.	3
Coccinella abdominalis	1	*Graptodera* sp.	1
Coccinella sp.	1	*Chætocnema* sp.	1
Adalia bipunctata	5	*Odontota nervosa*	1
Anatis 15-punctata	1	*Odontota* sp.	1
Anatis ocellata	1	*Coptocycla bicolor*	1
Scymnus americanus	1	*Coptocycla signifera*	1
Scymnus bruleri	1	*Cryptocephalus* sp.	1
Ips fasciatus	1	*Bruchus prosopis*	2
Monocrepidius vespertinus	1	*Epicærus imbricatus*	1
Agrilus sp.	3	*Otiorhynchus ligneus*	1
Chauliognathus marginatus	2	*Tanymecus confertus*	1
Chauliognathus sp.	1	*Sitones tibialis*	1
Telephorus sp.	2	*Phytonomus nigrirostris*	1
Atænius sp.	1	*Macrops* sp.	1
Aphodius fimetarius	4	*Barytychius amœnus*	1
Aphodius ruricola	4	*Endalus æratus*	1
Aphodius inquinatus	10	*Anthonomus grandis*	6
Aphodius sp.	2	*Conotrachelus seniculus*	1
Dichelonycha sp.	2	*Conotrachelus nenuphar*	1
Exema conspersa	2	*Ceutorhynchus* sp.	1
Pachybrachys othonus	1	*Rhinoncus pyrrhopus*	1
Metachroma sp.	1	*Baris ærea*	1
Colaspis brunnea	1	*Balaninus uniformis*	1
Nodonota tristis	1		

DIPTERA.

Bluebottle fly (*Lucilia cæsar*)	1

HEMIPTERA.

Brochymena sp	2	*Euura* sp	1
Sinea diadema	2		

Vegetable food.—Fruit amounts to 1.83 per cent, and consists of Rubus seeds found in 2 stomachs, elderberry seeds in 2, pokeberry seeds in 1, rough-leaved cornel in 1, and fruit skins not further identified in 4. Various seeds were contained in 6 stomachs, and rubbish in 3; altogether they amount to 0.34 per cent.

The following fruits and seeds were identified:

Yellow wood sorrel (*Oxalis stricta*)	1	Elderberries (*Sambucus canadensis*)	2
Blackberries or raspberries (*Rubus* sp.)	2	Pokeberries (*Phytolacca decandra*)	1
Rough-leaved cornel (*Cornus asperifolia*)	1	Knotweed (*Polygonum* sp.)	1
		Timothy (*Phleum pratense*)	1
		Foxtail grass (*Chætochloa* sp.)	1

Summary.—In the food of the least flycatcher there is no evidence of direct injury to the farmer or horticulturist. The bird eats no grain and practically no fruit or other product of husbandry. It must be allowed that the bird destroys more useful insects than could be wished, but the injury it does in this way is comparatively slight.

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U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 45
HENRY W. HENSHAW, *Chief*

DISTRIBUTION AND MIGRATION OF NORTH AMERICAN HERONS AND THEIR ALLIES

BY

WELLS W. COOKE
Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., February 3, 1913.

Sir: I have the honor to transmit herewith, for publication as Bulletin No. 45 of the Biological Survey, a report on "The Distribution and Migration of North American Herons and Their Allies," by Wells W. Cooke, Assistant in the Biological Survey. Formerly widely distributed in the United States, and very abundant in certain localities, the herons in recent years have everywhere been greatly depleted in numbers, chiefly because of the demand for their plumage for millinery purposes. Several species of egrets bearing the coveted "aigrettes" have, indeed, been almost exterminated, and the few that remain in the United States owe their existence to protective laws and to an aroused public sentiment. This bulletin aims to give precise information as to the range of the several species, especially the breeding range, and in regard to their migration. These data are believed to be amply sufficient to form a basis for protective legislation by the States inhabited by the various species.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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DISTRIBUTION AND MIGRATION OF NORTH AMERICAN HERONS AND THEIR ALLIES.

INTRODUCTION.

The herons have attracted wide attention during late years, particularly because of the earnest efforts that have been made to prevent the utter destruction of the aigrette-bearing members of the family. The horrors necessarily attending the collection of the aigrettes have aroused bird lovers to unprecedented activity. As a result, in some parts of the Union stringent laws have been enacted, and the State machinery for bird preservation has been supplemented by large private subscriptions. Probably no family of birds ever had fuller protection on the statute books than is now enjoyed by the herons, while certainly no birds have ever been the recipients of more zealous care than is now accorded to the remaining colonies of the larger and smaller egrets.

The friends of the birds became aroused none too soon. The large breeding colonies of egrets have been completely destroyed, and only a few scattered remnants exist to serve as centers for reestablishing the species.

Most herons are colony breeding birds, and this fact has been one of the most potent factors in bringing about their destruction. A colony could easily be discovered by watching the lines of flight to and from the feeding grounds, and the succeeding operations were woefully simple. The hunter merely waited until the eggs hatched and then, taking his stand within the colony, shot the parent birds as they brought food to the young. No matter how much shooting was done, the old birds—then bearing the nuptial plumes in their greatest perfection—continued to return to their hungry young until the last one was killed. The starving of the young and the utter extinction of the colony were necessary sequels.

So long as these plumes could be sold for their weight in gold and there was an unlimited market for them, neither State laws nor the efforts of zealous game wardens availed much in checking the slaughter. More hopeful conditions are being secured at the present time by decreasing the market. Already in several of the States it has been made unlawful to sell the aigrettes or even to have them in possession with intent to sell. Could such a law be made general throughout the United States, the killing of aigrette-bearing birds would cease, because the slaughterer would have no market for his plumes. The birds will never be safe until this condition exists.

The larger egret and the snowy egret are the two species that have suffered most severely from the persecutions of the plume hunters, but the millinery trade has also levied a heavy toll on many other members of the group. The flamingo has ceased to breed anywhere in the United States. The roseate spoonbill has become extinct over more than half of its former range in the United States, and its total numbers are probably less than 5 per cent of what they were 50 years ago.

The reduction of numbers in the other herons and in the ibises has not been so pronounced, but several of the species have been driven from the northern two-thirds of their former breeding range and are now restricted to the wildest and most inaccessible parts of the Gulf States.

The food habits of herons and heronlike birds have not been thoroughly investigated. The flamingo is believed to subsist largely on shellfish and crustacea. The spoonbill and the ibises partake of the same fare, but add insects to the bill. The larger wood ibis feeds also on frogs and fishes.

All of the true herons are fond of fish, but in addition they consume many injurious creatures, such as crawfish, water snakes, meadow mice, and other rodents. In the West the great blue heron spends much of its time hunting for pocket gophers. There is no doubt that the herons—especially the black-crowned night heron and the great blue heron—do much damage about fish hatcheries and ponds used as fish preserves, and in such places they should be held in check. But their food habits have redeeming features, and pending conclusions based on careful study of the whole subject, no general aggressive measures against the birds should be permitted.

DISTRIBUTION.

The herons and their allies as a whole are tropical birds, barely extending to the warmer parts of the southern United States. This bulletin treats of 32 species, all that are known to occur in North America south to and including the West Indies and Panama.

One of these, the European heron, is accidental in Greenland; two are stragglers to the southern United States; and several have never been taken within the limits of the United States.

SOUTHERN SPECIES NOT RANGING NORTH TO THE UNITED STATES.

Scarlet ibis (*Guara rubra*). Accidental five times in the United States.
Cayenne ibis (*Harpiprion cayennensis*).
Jabiru (*Jabiru mycteria*). Accidental once in the United States.
Zeledon boatbill (*Cochlearius zeledoni*).
Pinnated heron (*Botaurus pinnatus*).
Lembeye green heron (*Butorides brunescens*).
Striated heron (*Butorides striata*).
Agami heron (*Agamia agami*).
Pileated heron (*Pilherodius pileatus*).
Lineated tiger-bittern (*Tigrisoma lineatum*).
Nicaraguan tiger-bittern (*Tigrisoma excellens*).
Mexican tiger-bittern (*Heterocnus cabanisi*).

SPECIES OCCURRING DURING THE BREEDING SEASON NOT FARTHER NORTH THAN THE SOUTHERN PART OF THE UNITED STATES.

Flamingo (*Phoenicopterus ruber*). No longer breeds in the United States, but occurs as a rare visitor.
Roseate spoonbill (*Ajaia ajaja*).
White ibis (*Guara alba*).
Glossy ibis (*Plegadis autumnalis*).
Wood ibis (*Mycteria americana*).
Great white heron (*Ardea occidentalis*).
Egret (*Herodias egretta*).
Snowy egret (*Egretta candidissima*).
Reddish egret (*Dichromanassa rufescens*).
Louisiana heron (*Hydranassa tricolor ruficollis*).
Little blue heron (*Florida caerulea*).
Yellow-crowned night heron (*Nyctanassa violacea*).

SPECIES OF WIDE RANGE IN THE UNITED STATES AND CANADA DURING THE BREEDING SEASON.

White-faced glossy ibis (*Plegadis guarauna*).
Bittern (*Botaurus lentiginosus*).
Least bittern (*Ixobrychus exilis*).
Cory least bittern (*Ixobrychus neoxenus*).
Great blue heron (*Ardea herodias*).
Green heron (*Butorides virescens*).
Black-crowned night heron (*Nycticorax nycticorax naevius*).

SUMMARY.

Species of wide range in the United States	7
Species ranging north to the southern United States	12
Species not ranging north to the United States	10
Tropical species occurring as stragglers in the United States	2
Species occurring as a straggler from Europe	1
Total	32

MIGRATION.

The herons that breed south of the United States are for the most part nonmigratory. The same is true of the herons breeding in the tropical parts of Florida and Texas. All herons breeding farther north are at least partially migratory, for although a few individuals may remain through the winter in the vicinity of the nesting site, yet the great majority retire at this season to more genial climes. Those breeding north of the Gulf States are almost completely migratory, though occasionally a bittern, a great blue heron, or a black-crowned night heron elects to spend the winter where large swamps or warm springs offer a precarious livelihood far north of the freezing line.

The most striking peculiarity of the migrations of the herons is their northward movement in the fall. Though not universal, yet it is a common habit for the young herons to wander in the late summer and early fall long distances, even several hundred miles, north of the district where they were hatched. They remain from a week to a month at their picnic grounds and finally depart for their winter home.

A still more remarkable migration habit is that of the snowy egret. Numbers of these birds migrate in the spring far north of the breeding range and remain throughout the summer in these northern districts as nonbreeders. The birds are, of course, adults, and sometimes they are found during the summer 500 to 1,000 miles north of the nearest known breeding grounds of the species. This habit of the snowy egret seems not to be shared by any other North American species.

The data in this bulletin on the distribution and breeding of the several species have been obtained largely from the printed records in ornithological literature. The extended migration tables are made possible by the reports of many hundred observers who have filled out migration schedules for the Biological Survey. Occasion is taken herewith to extend to these observers well-merited thanks for their painstaking care and for the large amount of time they have devoted to the study of bird movements.

NORTH AMERICAN HERONS AND THEIR ALLIES.

Flamingo. *Phoenicopterus ruber* Linnæus.

Range.—Florida, Yucatan, and the Bahamas, and southeast through the West Indies to Venezuela, the mouth of the Amazon, and the Galapagos; accidental in South Carolina and Louisiana.

Breeding range.—The flamingo is not a migrant in the ordinary sense of the word, and its occurrence outside of the breeding range is due to its wandering into contiguous regions in search of food. The species nested formerly among the keys of southern Florida in the vicinity of Indian Key (Audubon), and Cape Sable (Scott), but was driven away many years ago, and there seems to be no certain record of breeding in Florida during the past 20 years.

The principal breeding range seems to have been the Bahamas, which furnished in abundance the peculiar natural conditions required for the nesting site. Nests have been known throughout the Bahamas from Great Abaco (Allen), on the north to Great Inagua (Bryant), on the south, and as late as 1905 the birds were still nesting in considerable numbers on Andros Island (Riley). Large breeding colonies have existed in the vicinity of Cienfuegos, Cuba, and this port has been for many years one of the principal places of shipment for live flamingos. The flamingo is also known to have nested on the Isle of Pines (Gundlach); Rio Lagartos, Yucatan (Boucard); Bonaire Island, off the coast of Venezuela (Hartert); near the mouth of Waini Creek on the coast of British Guiana (Lloyd); on the coast of French Guiana near Cayenne (Waterton); and south to the vicinity of the mouth of the Amazon River at Praia de Cajutuba, Brazil (Pelzeln), and to the Galapagos Islands (Beck).

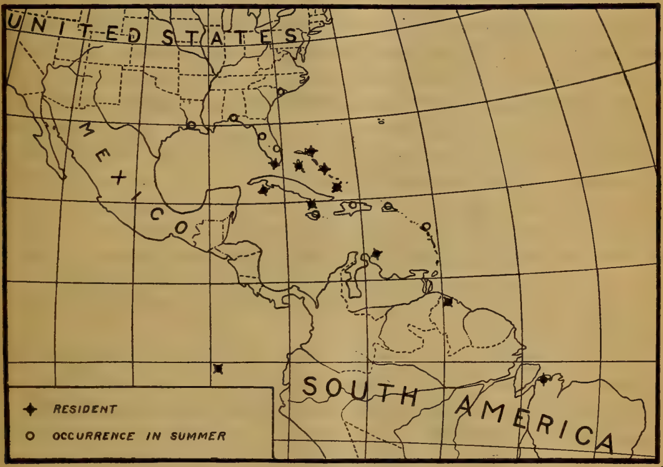

FIG. 1.—Flamingo (*Phoenicopterus ruber*).

Eggs have been found in the Bahamas, May 14, 1884 (Maynard); June 7, 1886 (Blake); and May 8, 1904 (Chapman); young out of the nest in the Bahamas, May 28, 1898 (Chapman); young on the Galapagos, April 1, 1902 (Beck).

Migration range.—Outside of the breeding season the flamingo used to be not uncommon on the west coast of Florida north to Tampa Bay (Scott), and a few probably still visit Florida, for they were noted at Upper Matecumbe Key, March 7, 1906 (Brodhead), and Lake Worth, May, 1905 (Ryman), but none probably winter anywhere in Florida. The flamingo has been noted also at Warrington, Fla. (Stone); Charleston, S. C. (Audubon); Georgetown, S. C., September, 1876 (Loomis); and at Cameron, La., December 6, 1910

(McAtee). One visited Bermuda September 24, 1849 (Hurdis, and the species has been recorded as a visitor to Jamaica (March), Haiti (Ritter), Porto Rico (Gundlach), Guadeloupe, Antigua, Anegada (Clark), Colombia (Masquera), and the Orinoco River in Venezuela (Burger).

Roseate Spoonbill. *Ajaia ajaja* (Linnæus).

Range.—Florida, Louisiana, Texas, and central Mexico, south to southern Patagonia; formerly north casually to South Carolina and Indiana; accidental in Pennsylvania, Wisconsin, Kansas, Colorado, and California.

Breeding range.—The roseate spoonbill as a breeder in the United States was confined to the extreme southern parts of Texas, Louisiana, and Florida. It has been known to nest in the lower Rio Grande Valley (Merrill); Grigsby, near Beaumont, Tex. (Rachford); Calcasieu (Kopman), Lake Arthur (Beyer), and Bayou Sara, La. (Beckham); and on the coast of southern Florida north to Indian River (Bryant) and Anclote Keys (Scott). Though sadly depleted in numbers and on the verge of extinction, yet the species probably still breeds near Cape Sable, Fla. (Bowdish), and Lake Arthur, La. (Beyer, Allison, and Kopman), while as late as July, 1910, a flock of about 50 was seen at the Indian Key Bird Reservation in Tampa Bay, Fla. (Pillsbury). Late records in Texas are at Rockport, August, 1905 (Howell) and at Brownsville June, 1907, and August, 1909 (Smith).

The pink curlew, as this bird is often called, has a wide distribution south of the United States. It is resident on both coasts of Mexico and on the large lakes of the interior, ranging on the Pacific Coast north to Mazatlan (Lawrence). It is known to breed in Nicaragua (Ridgway) and Costa Rica (Nutting) and has been recorded as occurring in Guatemala (Goss), Panama (Sharpe), and Colombia (Robinson). It used to be a common breeder in Great Inagua Island, Bahamas (Cory), in Cuba (Gundlach), and on the Isle of Pines (Poey), but is now rare if not extinct throughout this region. It has been recorded as a rare visitant to Jamaica (March), Haiti (Tristram), Porto Rico (Bowdish), and several of the Lesser Antilles including Trinidad Island (Leotaud), while from the coast of Venezuela (Ernst) south to Bahia Blanca, Argentina (Barrows) and to Santiago, Chile (Philippi), it is not rare either on the coast or in the interior on the larger rivers. A few have wandered south to the Falkland Islands (Abbott) and the Strait of Magellan (Sclater and Hudson).

The breeding season is evidently exceedingly variable and greatly extended. The National Museum contains eggs taken near Key

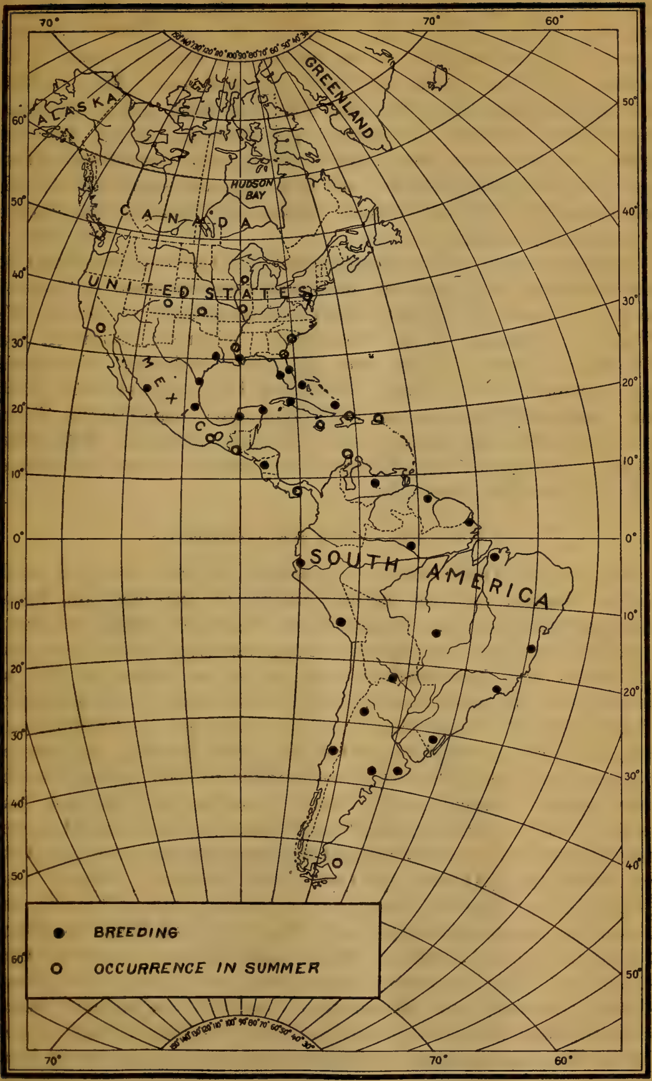
ALASKA
GREENLAND
HUDSON BAY
CANADA
UNITED STATES
MEX
C
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER
70°
70°
60°
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50°
60°

FIG. 2.—Roseate spoonbill (*Ajaia ajaja*).

West, Fla., January 16, 1886, and at Lake Okeechobee, Fla., March 14, 1874. Young nearly fledged were found April 1, 1858, on Indian River, Fla. (Bryant), and young in the nest April 19, 1882, at La Palma, Costa Rica (Nutting); both eggs and young May 1, 1903, at Cuthbert Lake, Fla. (Bent and Job) and fresh eggs at the same place March 29, 1908 (Chapman); eggs in June, Inagua, Bahamas (Cory); eggs June 2, 1886, Grigsby Bluff, Tex. (Rachford); fresh eggs in Cuba in early August, and both eggs and young at intervals throughout the fall, until finally young were found in the nest in December (Gundlach).

Migration range.—The roseate spoonbill is resident throughout its breeding range, but wanderers have been taken or noted at Cumberland, Ga., April 13, 1902 (Helme); Charleston, S. C., June, 1879 (Wayne); Yemassee, S. C., fall of 1885 (Wayne); Lancaster, Pa., (Warren); Rodney, Miss., June 27, 1889 (Mabbett); Vincennes, Ind., spring of 1856 (Butler); Portland, Ind., July 14, 1889 (Butler); Janesville, Wis., August, 1845 (Kumlein); near Wichita, Kans., March 20, 1899 (Matthews); Silverton, Colo., spring of 1888 (Morrison); near Pueblo, Colo., August, 1890 (Smith); San Bernardino, Cal., June 20, 1903 (Stephens).

White Ibis. *Guara alba* (Linnæus).

Range.—The Gulf States and central Mexico, south through Central America and the Greater Antilles to Venezuela and Peru; casual north to Vermont, Illinois, South Dakota, Colorado, and Utah.

Breeding range.—Throughout Florida the white ibis has been one of the most abundant breeding birds, and it has suffered so little at the hands of the plume hunters that it is still common in many parts of the State and in some places is really abundant. At Cuthbert and Alligator Lakes, near Cape Sable, Fla., two breeding colonies of more than a thousand birds each were found in 1903, and still larger ones reported farther inland (Bent). A colony of 4,000 nests was found in 1911 at Orange Lake, Fla. (Pearson). The species becomes less common to the northward, but has been known to nest north to St. Marys, Ga. (Arnow), southern South Carolina (Wayne), and Chipley, Fla. (Pleas). Though not so common west of Florida, yet it is not a rare breeder in southern Mississippi (Allison), southern and southwestern Louisiana (Beyer), and north to Natchez, Miss. (Audubon). It is less common on the Texas coast, breeding at Corpus Christi (Sennett) and Brownsville (Merrill), and occurs thence along the coast of eastern Mexico, on the larger inland lakes, and on the Pacific coast north to Mazatlan (Lawrence) and to Santa Margarita Island (Anthony). Though formerly abundant and still common in Cuba (Gundlach) and Isle of Pines (Bangs and Zappey), it seems not to have been common in the rest of its range in the West

Indies, though recorded from Jamaica (Field), Haiti (Christi), and Dominica (Clark). It occurs locally and not rarely along the whole Pacific coast of Central America south to the Rio Sabana, Panama (Salvadori and Festa), and has been recorded at the following places in northern South America: Zulia and Lake Valencia, Venezuela (Ernst); Vaqueria, northwestern Ecuador (Hartert); and Santa Luzia, northwestern Peru (Taczanowski).

Eggs have been taken March 28, 1898, at Lake Okechobee, Fla. (specimens in Thayer collection); April 24, 1888, at Tarpon Springs, Fla. (Scott); fresh eggs, May 1, 1903, at Cuthbert Lake, Fla.; and young able to fly, May 15, 1903, at Alligator Lake, only a few miles distant (Bent). In Cuba these birds are said to nest from April to September.

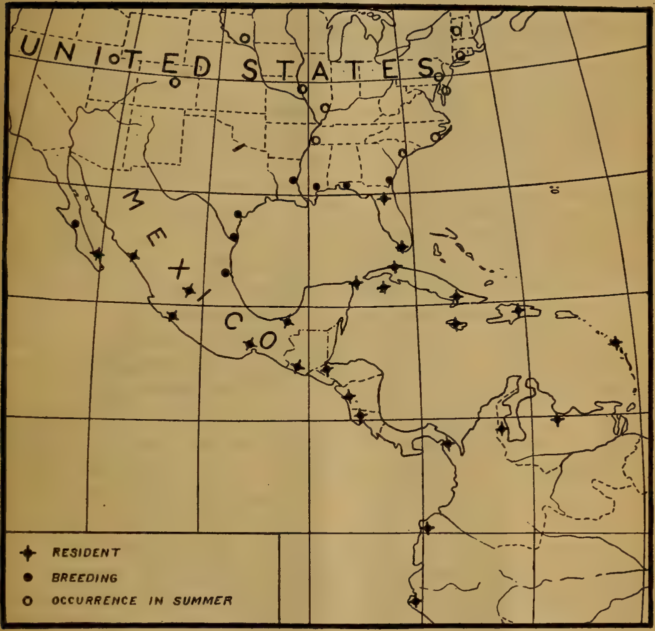

FIG. 3.—White ibis (*Guara alba*).

Winter range.—The white ibis is resident throughout its range in Central and South America and the West Indies. It winters in the United States north to Gainesville, Fla. (Chapman), and to southern Louisiana (Beyer, Allison, and Kopman), and in western Mexico north to La Barca (Goldman), Mazatlan (Lawrence), and to La Paz (Belding).

Spring migration.—A slight northward migration occurs in spring, bringing the birds to Whitfield, Fla., March 17, 1903 (Worthington); Pensacola, Fla., March 19, 1886 (Evermann); St. Marys, Ga., March 17, 1904 (Arnow). Beyond this they have been taken as wanderers at Beaufort, N. C., July 26, 1908 (Pearson); Philadelphia, Pa. (Warren); Great Egg Harbor, N. J., 1858 (Turnbull); Moriches and Raynor South, N. Y. (Giraud); Milford, Conn., May 23, 1875 (Merriam); South Woodstock, Vt., summer of 1878 (Tracy); Memphis, Tenn. (Audubon); Quincy, Ill. (Widmann); Mt. Carmel, Ill., May 8, 1878 (Ridgway); Vermilion, S. Dak., May, 1879 (Agersborg); Barr Lake, Colo., 1890 (Smith); Ogden, Utah, September, 1871 (Allen).

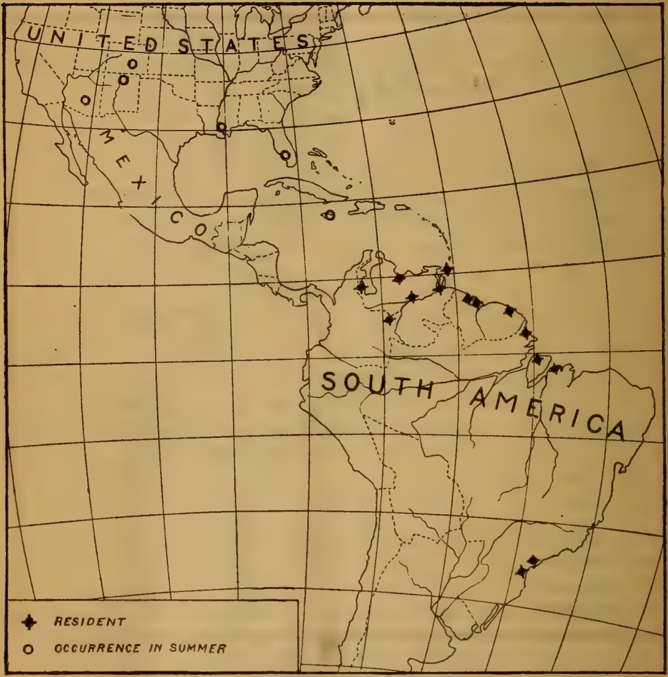

FIG. 4.—Scarlet ibis (*Guara rubra*).

Scarlet Ibis. *Guara rubra* (Linnæus).

The range of the scarlet ibis is northern South America from eastern Colombia to the mouth of the Amazon; north casually to the United States.

The principal home of this bird is the northern coast of South America from Zulia, Venezuela (Ernst), and Trinidad Island (Leotaud) to the mouth of the Amazon (Allen). It penetrates the interior of Colombia to the Meta River (Burger), follows the Amazon up to the Rio Negro (Ihering), and goes south on the coast of Brazil to Iguape, Sao Paulo (Ihering). When Waterton visited South America in 1812, he found scarlet ibises in innumerable flocks along the coast of British Guiana near Georgetown and four years later found them equally abundant on the coast of French Guiana, both east and west of Cayenne. The brilliant coloring of the bird early drew to it the attention of the plumage hunter, and about 1895 its skins formed a not inconsiderable part of the $200,000 worth of plumage exported yearly from Para, Brazil (Goeldi). Though sadly depleted in numbers, yet it is still far from extinction, for as late as March, 1909, several hundred were in sight at once on the Waini River, British Guiana (Beebe).

The scarlet ibis is only a very rare straggler in the United States and the West Indies. The records north of South America are: Costa Rica (Zeledon); Jamaica previous to 1847 (Denny); Fort Ogden, Fla., May, 1888 (Scott); Bayou Sara, La., July 3, 1821 (Audubon); Los Pinos, N. Mex. (Coues); Fort Lowell, Ariz., September 17, 1890 (Brown); Grape Creek, Wet Mountain Valley, Colo. (Lowe). Linnæus based his name of this species on Catesby's plate and description of birds that were said to have come from the Bahamas, but since the scarlet ibis has no other record for the Bahamas, it is probable that Catesby was misled as to the origin of his birds and that they really came from South America.

Eggs were taken May 2, 1901, in Dutch Guiana (specimens in Thayer collection).

Glossy Ibis. *Plegadis autumnalis* (Linnæus).

The glossy ibis has a wide range in the tropical and subtropical regions of the Eastern Hemisphere, extending north to Spain, Hungary, Greece, Persia, Turkestan, and China, and south to southern Africa, Borneo, and Australia. A very small percentage of the species occurs in the Western Hemisphere, where it is found principally in Jamaica, Cuba, Florida, and Louisiana; casual north to Nova Scotia, Ontario, Wisconsin, Nebraska, and Colorado.

The status of this species in Florida is not well defined. Both this and the white-faced glossy ibis occur in Florida, breeding in close proximity, and they agree so closely in appearance that they can not be distinguished by sight at ordinary distances. Hence it is possible that some of the following records of the glossy ibis refer really to the white-faced species. The former is recorded from

Fort Myers, spring of 1886 (Scott); Caloosahatchee River, April 20, 1881 (specimen in U. S. National Museum); Orlando, nested 1909 (Hyer); Gainesville, nested 1910 (Baynard); Micanopy, nested (Baird, Brewer, and Ridgway); Tortugas, 1860 (specimen in U. S. National Museum); Upper St. Johns, summer 1903 (Bent); near Cape Sable, summer 1903 (Bent); Orange Lake, Fla., eggs May 4–12, 1911 (Philipp).

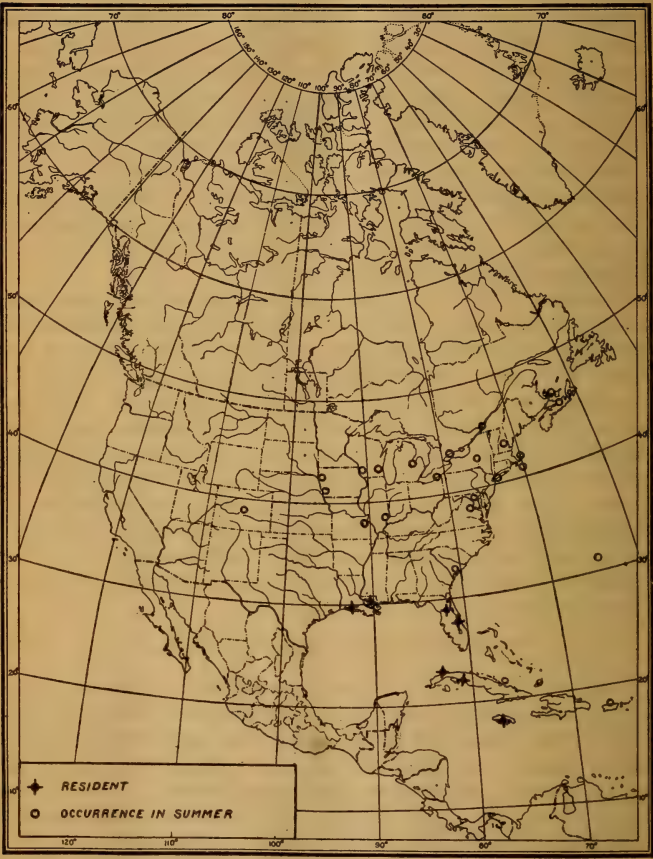

Fig. 5.—Glossy ibis (*Plegadis autumnalis*).

The Louisiana records also are in an unsatisfactory condition. Apparently both species of glossy ibis occur at Lake Arthur and both breed there, but their relative distribution in the rest of the State remains to be determined.

The glossy ibis is known locally as a wanderer along the whole Atlantic coast of the United States: Frogmore, S. C., June 30, 1884 (Hoxie); Washington, D. C., about 1817 (Audubon) and September, 1900 (Daniel); Baltimore, Md., May, 1817 (Audubon); Great Egg Harbor, N. J., May 7, 1817 (Ord); near Philadelphia, Pa., 1866 (Turnbull); 10 occurrences in New York State since 1844, between April and September, the latest being at Cayuga, May 21, 1907 (Fuertes); Middletown, Conn., May 9, 1850; near Cambridge, Mass., 5 birds, May 7 and 8, 1850 (Browne); Nantucket, Mass., September, 1869 (Allen); Cape Cod, Mass., May 4 and 5, 1878 (Allen); Alton, N. H., October, 1858 (Palmer); Pictou County, Nova Scotia, about 1865 (McKinlay); Prince Edward Island (Baird, Brewer, and Ridgway); Montreal, Canada, May 27, 1900 (specimen in Thayer collection). The species has been observed a few times inland: In Illinois, opposite St. Louis, February 27, 1880 (Hurter); Fairport, Ohio, 1848 (Wheaton); Bay City, Mich., October 6, 1884 (Eddy); Hamilton, Ontario, May, 1857 (McIlwraith); Horicon, Wis., November 3, 1879 (Kumlein and Hollister); Denver, Colo. (Cooke); Barr Lake, Colo., June, 1905 (Hersey and Rockwell). These last two records are far west of the normal range of the species and would be expected to be the white-faced glossy ibis, but there is no question of the correctness of the identification of the specimens.

The glossy ibis has been found as a rare breeder in western Cuba, at Zapata, Cardenas, and Habana (Gundlach), and was taken undoubtedly breeding at Spanishtown, Jamaica, May 16, 1865 (specimen in U. S. National Museum). One was taken February 22, 1900, at Cay Lobos Light, Bahamas (Bonhote), and one was seen in 1909 on Great Inagua, Bahamas (Worthington). There are rather uncertain records for four others of the West Indies.

White-faced Glossy Ibis. *Plegadis guarauna* (Linnæus).

The range of this bird is from central Mexico north to Louisiana, Utah, and Oregon; casual north to Minnesota, Wyoming, Idaho, and southern British Columbia; also in the southern half of South America; accidental in Costa Rica.

The white-faced glossy ibis is one of the few species of the heron tribe that are considered by law as game birds, and it is so considered in the United States in California only. Here it has an open season from October 15 to March 1, except in game district 6 (comprising the southern counties), where the season opens October 1. The bag limit is 20 birds in any one day and all sale within the State or shipment without the State is prohibited. The species is most common

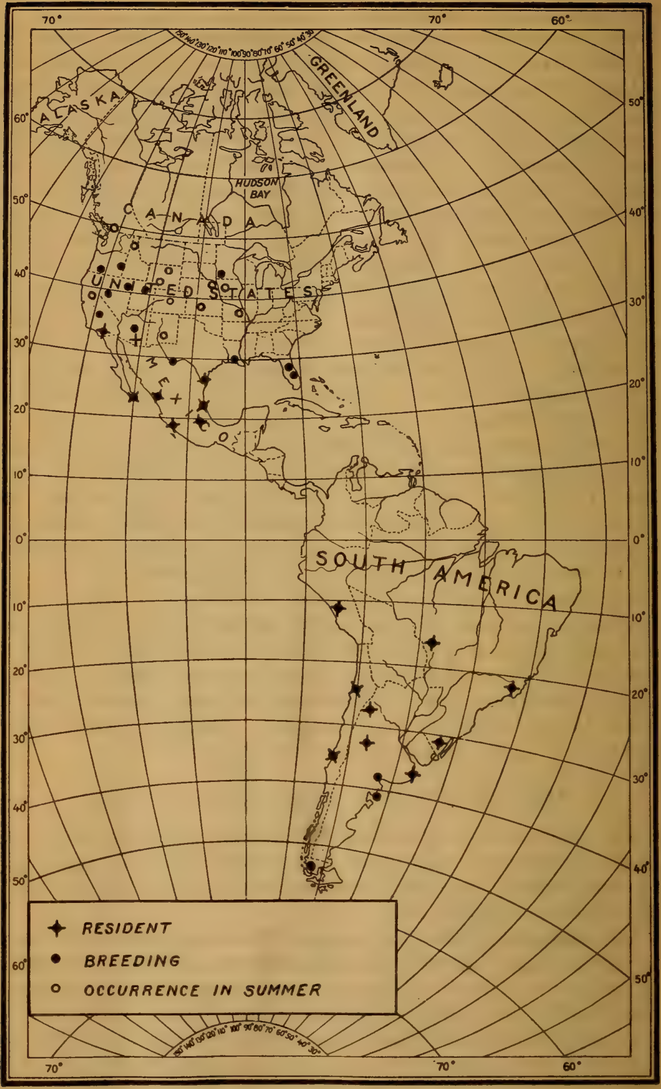
ALASKA
CANADA
HUDSON BAY
GREENLAND
UNITED STATES
MEXICO
SOUTH AMERICA
✦ RESIDENT
● BREEDING
○ OCCURRENCE IN SUMMER

FIG. 6.—White-faced glossy ibis (*Plegadis guarauna*).

in the southern and central parts of the State, especially in the San Joaquin Valley.

In all but three of the other States where the white-faced glossy ibis occurs it is protected by law for the most part under the provisions of the general law that protects all but certain specified game birds. In Nevada, Kansas, and New Mexico, however, the species is not protected by law at any time in the year.

The habitat of the white-faced glossy ibis presents one of the best examples of a discontinuous range. The bird is apparently absent from the whole of Central America and from northern South America and the valley of the Amazon River. To the northward it ranges from latitude 18° to 44°, while south of the equator the range extends from 12° to 55°.

The white-faced glossy ibis breeds from the Valley of Toluca (Goldman), Manzanillo Bay (Lawrence), and San Jose del Cabo (Belding), Mexico; north to Great Salt Lake, Utah (Goodwin), and Malheur Lake, Oreg. (Finley). It also breeds along the coast of Texas, at Lake Arthur, La. (specimen in U. S. National Museum), and at Lake Washington, Fla. (Brewster). The species probably ranges regularly east to southwestern Louisiana, but, as already remarked under the last species, how common or regular it is in Florida remains yet to be determined. The species has wandered north to Rippey, Iowa, April, 1891 (Nutting); Spirit Lake, Iowa, May 15 to 21, 1890 (Mosher); Heron Lake, Minn., nested in 1894 and 1895 (Peabody); near Omaha, Nebr., August 19, 1893, and April 6, 1897 (Bruner, Wolcott, and Swenk); Red Bank, Wyo., 1893 (Knight); Lake Pend Oreille, Idaho, 1909 (Moody); Salt Spring Island and the mouth of the Fraser River in southwestern British Columbia (Fannin).

The white-faced glossy ibis winters throughout its range in Mexico and north to Brownsville, Tex. (Merrill); Gum Cove, La. (McAtee); Tombstone, Ariz. (Willard); and Los Angeles County, Cal. (Grinnell).

The breeding range in South America extends from near Callao, Peru (Cassin); and Rio Janeiro, Brazil (Sharpe); south to the Strait of Magellan (Dabbene); and the species is common on the larger rivers of the interior north to Ypanema, Brazil, on the Paraguay River at 16° south latitude (Pelzeln). It retires in the winter from the southern part of this breeding range, but remains at this season as far south as Cape San Antonio, Argentine (Gibson); and Santiago, Chile (specimen in U. S. National Museum).

The regular ranges in North America and South America are separated by 30° of latitude and 22° of longitude. There is only one record for the species in the whole 3,000 miles—a single bird, taken on the Diquis River in southwestern Cost Rica (Cherrie), which had wandered about 1,200 miles from the nearest part of the bird's regular home.

Eggs are most commonly found in Argentina during November (Holland) and in Chile during November and December (Germain). North of the equator eggs have been taken at Lake Washington, Fla., April 18, 1886 (Brewster); Heron Lake, Minn., June 26, 1894, June 22 and July 2, 1895 (Peabody); Brownsville, Tex., May 16, 1877 (Merrill); Waco, Tex., April 22, 1900 (specimens in Thayer collection); San Diego, Cal., May 29, 1893 (Shields); Quinn River, Nev., May 11, 1881 (specimens in U. S. National Museum).

Wood Ibis. *Mycteria americana* Linnæus.

The range of the wood ibis is from the Gulf States and central Mexico south through Cuba and Central America to Argentina; casual north to New England, Ohio, Wisconsin, Montana, and California.

This bird is a tropical species of wide distribution in Central and South America. It is common in the United States only in Florida and along the Gulf coast to southern Texas. It breeds less commonly north to Colleton County, S. C. (Wayne); and to Rodney, Miss. (Mabbett); while in Mexico the breeding range extends north to Mazatlan and La Paz.

After the breeding season and when the young are fully grown both old and young are in the habit of moving northward to the swamps along the Mississippi River, particularly in southeastern Missouri and southern Illinois, which at this season of the year are swarming with their favorite food. Here they are common from July to September, while occasional flocks or individuals wander still farther and have been recorded at New Haven, Mo., August 11 to September 11, 1902 (Eimbeck); Brookville, Ind., August, 1855 (Evermann); Lyons, Ind., June 27, 1910, and June to September, 1911 (Van Gorder); Cleveland, Ohio (Jones); near Monroe, Mich., June 19, 1910 (Taverner); Racine, Wis., September, 1868 (Hoy); La Crosse, Wis., 1852 (Kumlein and Hollister); Ellis, Kans., March 26, 1885 (Goss); Waldron, Kans., June 29, 1908 (Matthews); Fort Thorn, N. Mex. (Henry); near Denver, Colo., August 30, 1902 (Felger); Ennis, Mont., October, 1902 (Cooley); Idaho City, Idaho, June 25, 1910 (Jewett).

The breeding birds of the coast of western Mexico also work northward in the fall, are especially common in the valley of the lower Colorado River, and are irregular visitants to southern California. They have been taken thence north to Fort Mohave, Ariz. (Coues); Rush Lake, Utah, October 1, 1872 (Yarrow and Henshaw); Nevada, July, 1871 (specimen in U. S. National Museum); and Hayward, Cal. (Grinnell).

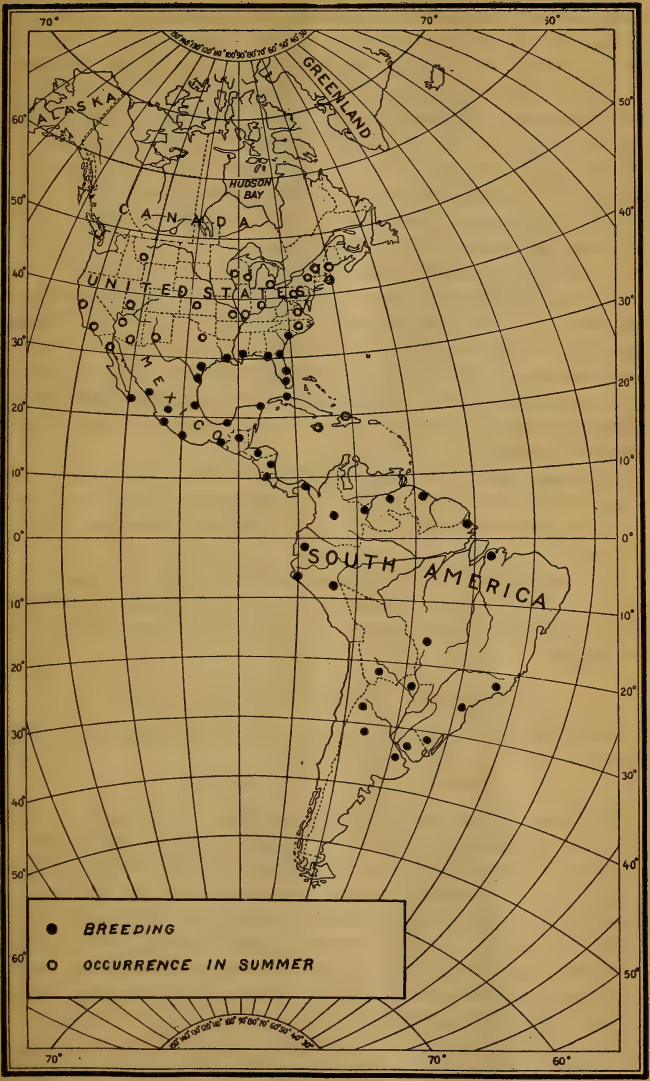
ALASKA
GREENLAND
HUDSON BAY
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER

FIG. 7.—Wood ibis (*Mycteria americana*).

The wood ibis has been noted in the eastern United States at Raleigh, N. C., July, 1884 (Brimley); Morganton, N. C. (Wayne); Vinitaville, Va., July 18, 1896 (Palmer); Bloomery, W. Va., about July 28, 1884 (Wall); Washington, D. C., July 2, 1892 (Palmer); Silver Hill, Md., July 20, 1896 (Palmer); Laurel, Md., July 27, 1896 (Palmer); Williamsport, Pa., June 21, 1876 (Allen); Elizabethtown, Pa., July 10, 1884 (Sherratt); Troy, N. Y., June 24, 1876 (Allen); near Glasco, N. Y., July 8, 1884 (Fisher); near East Marion, N. Y., June 21, 1890 (Dutcher); Barrington, R. I., August 8, 1896 (Hathaway); Georgetown, Mass., June 19, 1880 (Allen); Seekonk, Mass., July 17, 1896 (Brewster); Williston, Vt., about 1897 (Perkins); and Berwick, Me., July 16, 1896 (Knight).

The wood ibis occurs in favorable localities throughout Central America, much of northern South America, and south to Tumbez, Peru (Taczanowski); Cordoba, Argentina (Dabbene); and Concepcion, Argentina (Barrows). It is a rare resident of Cuba (Gundlach); occasional in the Isle of Pines (Cory); accidental in Jamaica (Denny); rare in Haiti (Christi); and recorded from Trinidad Island (Leotaud).

The larger part of the most northern breeding wood ibises retire a few miles to the southward during the winter season, but enough remain to allow the species to be called resident throughout its breeding range.

This species is one of the earliest breeding birds, since eggs are in the United States National Museum taken in Florida, December 8, 1859; Cape Sable, Fla., January 5, 1892; and in southeastern Yucatan, March 15, 1890.

[Cayenne Ibis. *Harpiprion cayennensis* (Gmelin).

Ranges from southern Sao Paulo, Brazil, and Ecuador north and west to the Panama Canal.]

Jabiru. *Jabiru mycteria* (Lichtenstein).

The range of the jabiru is from Colombia and Guiana to Argentina; rare in Central America; accidental in Mexico and Texas.

The sole claim of the jabiru to a place in the list of United States birds rests on a specimen donated to the museum of the Philadelphia Academy of Sciences and claimed to have been taken near Austin, Tex. The species is a rather rare resident of the lower parts of Costa Rica and Nicaragua, and has been recorded once from southern Guatemala at Haumuchal (Salvin); and once from southern Mexico at Cosamaloapam (Sumichrast).

The jabiru seems not to have been reported as yet from eastern Costa Rica, Panama, or western Colombia, but it occurs from northeastern Colombia (Robinson); Venezuela (Ernst); Tobago Island (Jardine); and British Guiana (Cabanis); south throughout Brazil

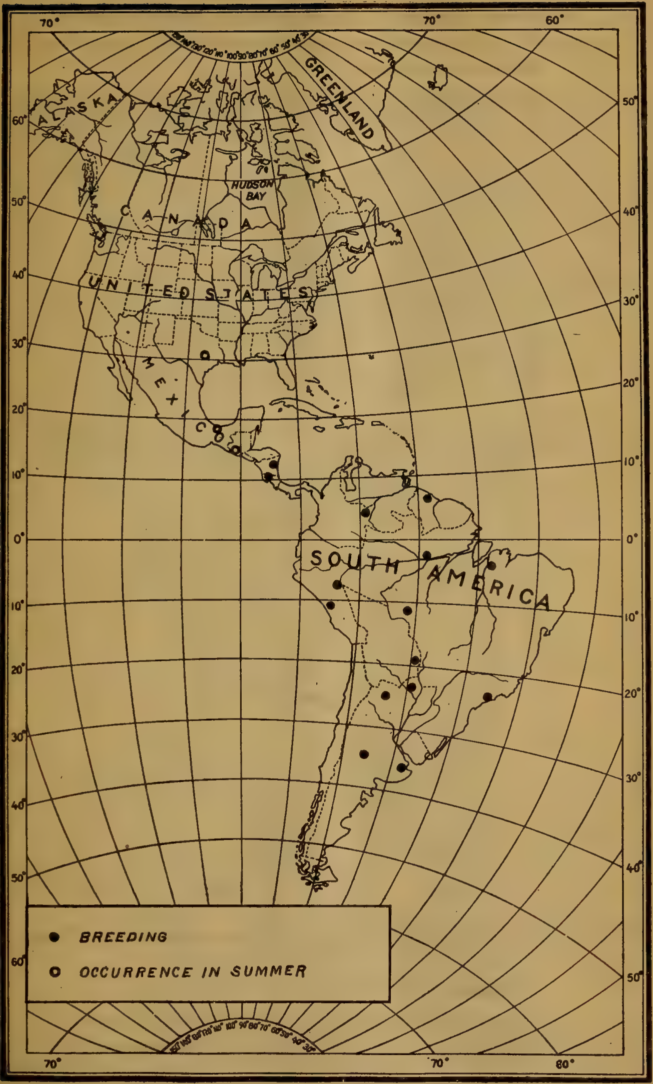
ALASKA
GREENLAND
HUDSON BAY
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER

FIG. 8.—Jabiru (*Jabiru mycteria*).

and Paraguay to Cordoba, Argentina (Dabbene); and to Buenos Aires, Argentina (Hudson). It also ranges west to central Peru (Taczanowski). Eggs were taken October 10, 1904, on the Chaco of Argentina (Hartert and Venturi).

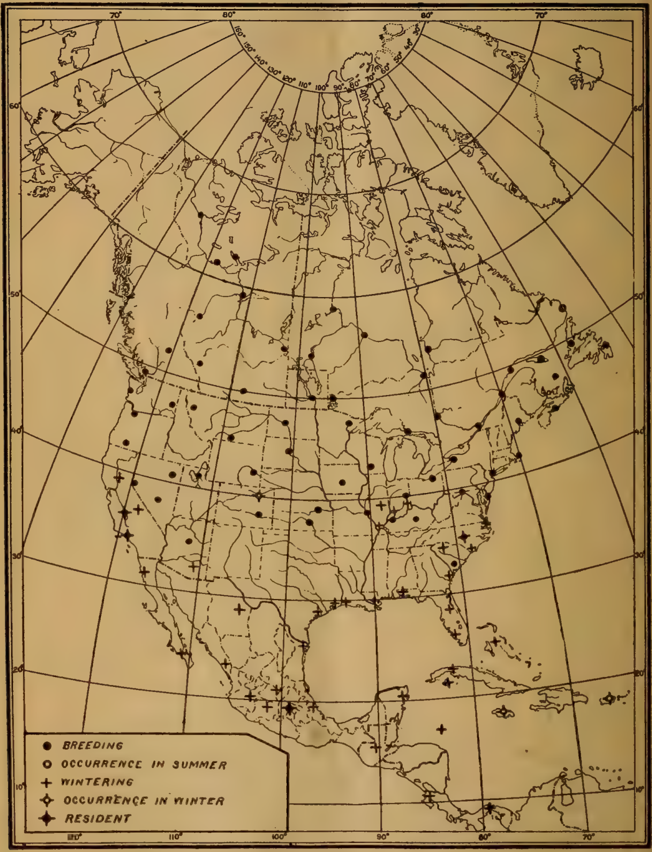
● BREEDING
O OCCURRENCE IN SUMMER
+ WINTERING
✧ OCCURRENCE IN WINTER
✦ RESIDENT
70°
80°
80°
70°
60°
50°
40°
30°
20°
10°
120°
110°
100°
90°
80°
70°

FIG. 9.—Bittern (*Botaurus lentiginosus*).

Bittern. *Botaurus lentiginosus* (Montagu).

Range.—Nearly the whole of North America, from Panama and the Greater Antilles north to British Columbia, Mackenzie, and Newfoundland.

Breeding range.—The bittern is one of the most northern breeding members of its family. During the summer it ranges north to the southern part of the Cariboo District, B. C. (Brooks); Peace River Landing, Alberta (Macoun); Fort Norman, Mackenzie (Preble); Prince Albert, Saskatchewan (Ferry); Fort Churchill, Keewatin (Clarke); Fort George, on the east side of James Bay (Selwyn); Godbout, Quebec (Comeau); Anticosti Island, Quebec (Verrill); Humber River, Newfoundland (Porter); and St. John, Newfoundland (Howley). It was once seen at Cape St. Francis near the Strait of Belle Isle (Bigelow). The southern boundary of the normal breeding range extends from Buena Vista Lake, Cal. (Goldman); Pahranagat Valley, Nev. (Merriam), and Utah Lake, Utah (Johnson), east to Barr Lake, Colo. (Felger), Wichita, Kans. (Matthews), Henderson, Ky. (Alves); Variety Mills, Va. (Micklem), and Cape May, N. J. (Hand). South of this normal summer range, the species has been found breeding at Lerma, Mexico (Goldman); Alamitos, Los Angeles County, Cal. (Robertson); Mormon Lake, Ariz. (Mearns); Raleigh, N. C. (Brimley); and Yemassee, S. C. (Wayne).

Winter range.—The principal winter home is in the southern United States, from which a few pass south throughout Mexico and as far south as Coban, Guatemala (Salvin); Reventazon, Costa Rica (Bangs); Cariblanco and Turrucares, Costa Rica (Lankester); Laguna de Ochomogo, Costa Rica (Carriker); and Isthmus of Panama (Lawrence). The species is not rare in western Cuba (Gundlach), the Isle of Pines (Gundlach), and the northern Bahamas (Bonhote). It winters north to Marysville, Cal. (Belding), the lower Ohio Valley, and North Carolina; and is rare or casual at Canton, Ill. (Cobleigh), and Washington, D. C. (Coues). One was seen December 28, 1904, at a warm spring near Fort Morgan, Colo. (Felger), far north of the usual winter home.

Migration range.—Specimens have been taken in Jamaica (Denny) and Porto Rico (Gundlach), though the species is not known to occur regularly in either of these islands. Many individuals have found their way, spring and fall, to Bermuda (Jardine), though their appearance there is so irregular as to suggest accident rather than design. A straggler to Piddletown, England, became the basis of the original description of the species.

Spring migration.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Raleigh, N. C.	9	Apr. 1	Mar. 19, 1908
Pea Island, N. C.			Feb. 11, 1901
Andrews, N. C.	2	Apr. 22	Apr. 18, 1902
Weaverville, N. C			Apr. 12, 1891
Washington, D. C.	3	Apr. 7	Mar. 22, 1894
Baltimore, Md.			Mar. 31, 1898
Erie, Pa.	5	Apr. 12	Apr. 4, 1888
Renovo, Pa.	6	Apr. 10	Mar. 29, 1907

Spring migration—Continued.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Northern New Jersey	3	Apr. 11	Mar. 27, 1909
Ithaca, N. Y.			Mar. 28, 1908
Canandaigua, N. Y. (near)	12	Apr. 22	Apr. 14, 1905
Jewett City, Conn. (near)	7	Apr. 21	Apr. 17, 1906
Beverly, Mass	9	Apr. 20	Apr. 15, 1909
West Groton, Mass	7	Apr. 22	Apr. 17, 1898
Monadnock, N. H	2	Apr. 16	Apr. 14, 1905
Phillips, Me	5	Apr. 25	Apr. 11, 1905
Pittsfield, Me	3	May 8	May 4, 1895
Fort Kent, Me			May 4, 1905
Montreal, Canada	5	Apr. 25	Apr. 20, 1908
Quebec, Canada	2	Apr. 27	Apr. 25, 1906
Pictou, N. S	9	Apr. 22	Apr. 15, 1892
Halifax, N. S	3	May 7	May 5, 1902
Blackville, N. B. (near)	3	May 11	May 7, 1906
North River, P. E. I			May 20, 1888
Godbout, Quebec			May 12, 1895
Fayetteville, Ark			Mar. 31, 1883
Monteer, Mo			Mar. 26, 1904
Odin, Ill	2	Apr. 5	Apr. 1, 1892
Canton, Ill			Jan. 15, 1894
Vincennes, Ind	2	Apr. 4	Apr. 3, 1888
Oberlin, Ohio	4	Apr. 10	Mar. 30, 1908
Detroit, Mich	3	Mar. 31	Mar. 17, 1905
Vicksburg, Mich	7	Apr. 7	Mar. 30, 1908
Point Pelee, Ont			Jan. 25, 1907
Guelph, Ont	4	Apr. 21	Apr. 13, 1895
Ottawa, Ont	16	Apr. 24	Apr. 16, 1897
Tampico, Ill	3	Apr. 10	Apr. 7, 1884
Chicago, Ill	16	Apr. 19	Mar. 29, 1907
Ripon, Wis			Apr. 12, 1879
La Crosse, Wis	5	Apr. 22	Apr. 8, 1909
Palmer, Mich	2	May 6	May 5, 1895
Central Iowa	12	Apr. 17	Apr. 4, 1890
Heron Lake, Minn	6	Apr. 20	Apr. 8, 1889
Elk River, Minn	4	Apr. 23	Apr. 9, 1887
Lake Andrew, Minn	4	Apr. 24	Apr. 19, 1893
White Earth, Minn			Apr. 17, 1880
Central Kansas	6	Apr. 17	Apr. 12, 1907
Kansas City, Mo	4	Apr. 18	Apr. 17, 1902
Valentine, Nebr. (near)	4	Apr. 27	Apr. 21, 1896
Huron, S. Dak	3	Apr. 17	Apr. 12, 1884
Sioux Falls, S. Dak	2	Apr. 11	Apr. 10, 1910
Harrisburg, N. Dak. (near)	6	May 2	Apr. 22, 1883
Aweme, Manitoba	10	May 3	Apr. 19, 1909
Indian Head, Sask. (near)	6	May 11	May 1, 1910
Denver, Colo	7	Apr. 20	Apr. 10, 1897
Salida, Colo			Apr. 16, 1908
Utah Lake, Utah			Mar. 30, 1899
Terry, Mont			Apr. 23, 1893
Edmonton, Alberta	4	May 21	May 14, 1908
Fort Providence, Mack	2	May 9	May 6, 1904
Aumsville, Oreg	4	Mar. 28	Mar. 21, 1889
Grays Harbor, Wash			Apr. 3, 1890
Chilliwack, B. C			Mar. 17, 1889
Okanagan Landing, B. C	2	Apr. 26	Apr. 23, 1908

The last bittern seen in the spring at Nassau, Bahamas, was on March 6, 1902 (Bonhote); Frogmore, S. C., April 4, 1887 (Hoxie); New Orleans, La., April 7, 1904 (Allison); Whitfield, Fla., April 22, 1903 (Worthington).

Eggs have been taken at Variety Mills, Va., May 12, 1884 (Micklem); Salem, N. J., May 28, 1904 (Stone); Lake Umbagog, Me., June 4, 1883 (Carpenter); Magdalen Islands, Quebec, July 14, 1887 (Bishop); Kewanee, Ill., May 22, 1893 (Murchison); Fays Lake, Mich., May 30, 1894 (Watkins); Detroit, Mich., May 21, 1899 (Swales); Leech Lake, Minn., June 6, 1902 (Currier); Julesburg, Colo., May 17, 1899 (Dawson); Alamitos, Los Angeles County, Cal., May 14, 1899 (Robertson); Fort Crook, Cal., May 12, 1861 (specimens in U. S. National Museum); near Crane Lake, Saskatchewan, June 7, 1905 (Bent). Young out of the nest were found at Guelph, Ontario, at the early date of June 1, 1901 (Walker), and young a week old at Meridian, N. Y., May 31, 1898 (Tabor).

Fall migration.

Place.	Number of years' records.	Average date of the last one seen.	Latest date of the last one seen.
Chilliwack, B. C.			Dec. 19, 1889
Indian Head, Sask.	2	Oct. 15	Oct. 16, 1907
Whitford Lake, Alberta			Oct. 29, 1909
Aweme, Manitoba	2	Oct. 10	Nov. 5, 1909
Marstonmoor, N. Dak			Nov. 9, 1909
Sioux Falls, S. Dak.	2	Nov. 7	Nov. 20, 1910
Barr Lake, Colo			Dec. 28, 1904
Nebraska City, Nebr			Nov. 8, 1909
Delavan, Wis.	3	Oct. 13	Oct. 16, 1894
Chicago, Ill.	5	Oct. 16	Nov. 28, 1895
Ottawa, Ont.	16	Oct. 23	Nov. 2, 1896
Palmer, Mich.			Oct. 31, 1894
Vicksburg, Mich.	5	Nov. 5	Nov. 12, 1902
Keokuk, Iowa	4	Oct. 31	Nov. 9, 1903
Kansas City, Mo.			Nov. 23, 1904
Minerva, Ohio			Nov. 10, 1892
Greensburg, Ind.			Dec. 25, 1892
North River, P. E. I.			Sept. 13, 1887
Montreal, Canada	6	Oct. 22	Nov. 11, 1894
Scotch Lake, N. B.			Nov. 22, 1900
Pictou, N. S.			Oct. 20, 1894
Pittsfield, Me.	3	Oct. 6	Oct. 9, 1895
Nantucket Island, Mass.			Nov. 3, 1896
Canandaigua, N. Y.			Oct. 30, 1905
Renovo, Pa.	3	Oct. 21	Nov. 11, 1900
Erie, Pa.	3	Oct. 24	Oct. 28, 1893
Cape May, N. J.			Nov. 19, 1878
Chester County, Pa.			Dec. 8, 1879

The first in fall migration arrived at Frogmore, S. C., August 26, 1886 (Hoxie), and at St. Marys, Ga., September 12, 1905 (Arnow).

[**Pinnated Heron.** *Botaurus pinnatus* (Wagler).

This species ranges in South America, in Argentina, Brazil, and Guiana, and has one somewhat doubtful record for Nicaragua (Lawrence).]

Least Bittern. *Ixobrychus exilis* (Gmelin).

Range.—North America north to Oregon, Saskatchewan, and New Brunswick, and thence south in winter to Chile and southern Brazil.

Breeding range.—The least bittern is a regular and common breeder in the eastern United States north of latitude 39° and west of New England. The breeding range extends north to St. John, N. B. (Chamberlain); Ottawa, Ontario (White); Grand Rapids, Mich. (Milliken); Ripon, Wis. (Cooke); White Earth, Minn. (Cooke); Crane Lake, Saskatchewan (Macoun); and probably in southern Manitoba. Its western limit is near the hundredth meridian at Hays, Kans. (Lantz); Long Pine, Nebr. (Bates); and Roscoe, S. Dak. Throughout the Rocky Mountain region the species is absent as a breeder, but appears again in small numbers along the Pacific coast at San Luis Rey, Cal. (Sharp); Los Angeles, Cal. (Grinnell); and

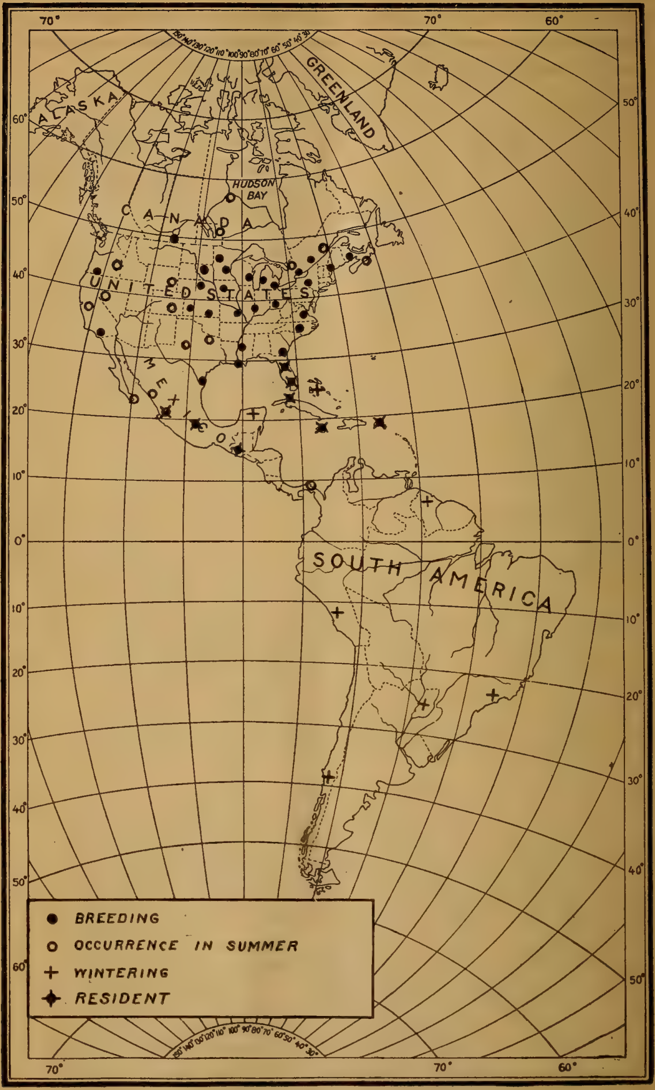
ALASKA
GREENLAND
HUDSON BAY
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
70°
70°
60°
60°
50°
40°
30°
20°
10°
0°
● BREEDING
○ OCCURRENCE IN SUMMER
+ WINTERING
✦ RESIDENT

FIG. 10.—Least bittern (*Ixobrychus exilis*).

Tule Lake, Oreg. (Bailey). It breeds rarely along the Atlantic coast from Washington, D. C. (Coues), to Raleigh, N. C. (Brimley), and Lake Ellis, N. C. (Philipp), and more commonly on the coast of South Carolina (Wayne), in Georgia (Perry), throughout most of Florida, and along the Gulf coast to the mouth of the Rio Grande (Merrill). There is thus a large part of the eastern United States south of the thirty-ninth parallel and back from the coast in which the species is either lacking or very rare.

The least bittern nests locally in a few places in central Mexico—Ocotlan, Jalisco (Nelson); La Laguna, Jalisco (Nelson); Patzcuaro, Michoacan (Stone); and the valley of Toluca (Goldman). It breeds also in Cuba (Gundlach); and Porto Rico (Gundlach).

Winter range.—The least bittern winters north to Micanopy, Fla. (Baynard); and Orlando, Fla. (Hyer); also in the Bahamas (Bonhote). In Mexico it occurs in winter north to San Blas, Tepic (Lawrence); Lake Patzcuaro, Michoacan (Jouy); and the valley of Toluca (Goldman). Thence it ranges south to Lion Hill, Panama (Sharpe); Georgetown, Guiana (Loat); Iguape, Brazil (Ihering); Paraguay (Berlepsch and Stolzmann); and to Valdivia, Chile (Boeck).

Migration range.—Records of migration or of wandering have been made at Halifax, N. S., March 16, 1896 (Piers); Quebec City, Canada (Dionne); Beaumaris, Ontario (Fleming); Shoal Lake, Manitoba, June, 1901 (Chapman); San Angelo, Tex., September 10, 1885 (Lloyd); Fort Thorn, N. Mex. (Henry); Boulder, Colo., May 25, 1910 (Betts); Cheyenne, Wyo. (Knight); Truckee Valley, Nev. (Ridgway); Malheur Lake, Oreg. (Bendire); Mazatlan, Sinaloa, September (Lawrence); San Jose del Cabo, Lower California, common in the fall (Brewster).

Spring migration.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Savannah, Ga	....	....	Mar. 6, 1908
Frogmore, S. C	....	....	Apr. 5, 1888
Manteo, N. C	....	....	Apr. 20, 1899
Raleigh, N. C	2	May 5	May 3, 1889
Washington, D. C	3	May 20	May 18, 1907
Erie, Pa	5	May 23	May 19, 1892
Williamsport, Pa	....	....	May 6, 1896
Brockport, N. Y	....	....	May 5, 1894
Providence, R. I	....	....	Feb. 28, 1881
Belmont, Mass	....	....	May 11, 1876
Opelousas, La	....	....	Apr. 13, 1837
Corpus Christi, Tex	....	....	Apr. 5, 1889
Escondido, Cal	....	....	Mar. 28, 1896
Quincy, Ill	4	Apr. 27	Apr. 22, 1888
Turlington, Nebr	....	....	May 6, 1900
Oberlin, Ohio	6	May 1	Apr. 25, 1904
Waterloo, Ind	3	May 3	Apr. 30, 1907
Chicago, Ill	6	May 14	May 6, 1890
Southwestern Ontario	8	May 16	May 13, 1905
White Earth, Minn	2	May 11	May 10, 1881
Heron Lake, Minn	4	May 18	May 9, 1889
Sioux Falls, S. Dak	....	....	May 11, 1908

Eggs have been taken at Fort Thompson, Fla., March 25, 1893 (specimens in U. S. National Museum); Titusville, Fla., April 10, 1905 (Worthington); St. Johns, Fla., April 18, 1902 (Bent); Rodney, Miss., May 10, 1887 (Mabbett); Raleigh, N. C., May 23, 1893 (young in nest) (Brimley); Philadelphia, Pa., May 29, 1907 (Miller); Portland, Conn., June 10, 1883 (Neff); Oak Forest, Ind., May 21, 1902 (Honecker); Canton, Ill., May 28, 1884 (Cobleigh); Des Moines, Iowa, May 26, 1885 (Keyes); Detroit, Mich., May 26, 1891 (Wood); Fort Snelling, Minn., May 28, 1903 (specimens in U. S. National Museum); Mud Lake, Minn., June 3, 1887 (Brownell). Eggs have been found in Porto Rico on May 7 (Gundlach); in Jamaica from May 29 (Field) to June 25 (Scott); in Guatemala June 1 (Oates); and at Purissima, Lower California, May 17, 1909 (Thayer).

Fall migration.—The latest fall date of the least bittern at Montreal, Canada, was on September 2, 1897 (Wintle); Middletown, R. I., September 14, 1901 (King); Erie, Pa., September 25, 1902 (Todd); Washington, D. C., September 19, 1881 (Richmond); Waterloo, Ind., October 1, 1906 (Link); Vicksburg, Mich., October 5, 1903 (Corwin); Oberlin, Ohio, October 17, 1909 (Jones); Indianola, Iowa, October 18, 1902 (Jeffrey); Toronto, Ontario, November 28, 1894 (Fleming); Dunlap, Cal., September 24, 1890 (Eaton); Sioux Falls, S. Dak., October 8, 1911 (Larson); Lincoln, Nebr., September 20, 1900 (Wolcott); Corpus Christi, Tex., September 29, 1886 (Sennett); and Bermuda, October 23, 1847 (Hurdis).

The earliest fall record at Lima, Peru, was on October 10, 1889 (Berlepsch and Stolzmann).

Cory Least Bittern. *Ixobrychus neoxenus* (Cory).

The Cory least bittern has a strange distribution, judging from the little as yet learned about the species. It is known to breed at the northern limit of the range in Ontario and also at its southern limit in Florida. It is known as a migrant only in the intervening region and is not known in winter anywhere.

It has been found nesting near Toronto, Ontario, and near Fort Thompson, Fla.; at the former place eggs were found June 15, 1898 (Fleming), and at the latter, young in the nest, June 8, 1890 (Scott). Near Toronto about 16 specimens have been taken in the summer, the earliest date being May 14, 1897, and the latest September 9, 1899, and young birds have been found from August 3 to 17. One specimen has been secured at each of the following localities: Watkins Lake, Jackson County, Mich., August 8, 1894 (Watkins); St. Clair Flats, Mich., May 14, 1904 (Taverner); Toledo, Ohio, May 25, 1907 (Ruthven); Lake Koshkonong, Wis., May 22, 1893 (Cherrie); and Scituate, Mass., May 18, 1901 (Brewster). The above are probably all the records that have been published for this species north of Florida.

The records in this latter State come from a restricted area in the vicinity of the western side of Lake Okechobee and extend over the three summer months from May 19, 1890, to August 15, 1891. A number of specimens have been taken, showing that the bird is not rare in that region, but so far there are no winter records for the species anywhere, and nothing to indicate where the birds spend the time from September to May.

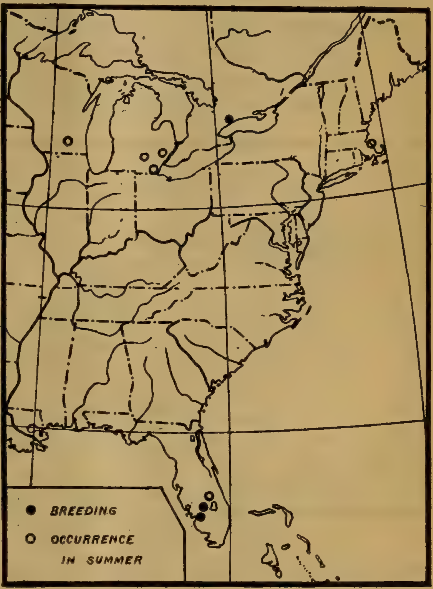

FIG. 11.—Cory least bittern (*Ixobrychus neoxenus*).

Great White Heron. *Ardea occidentalis* Audubon.

The great white heron has the most restricted range of any of the herons of North America. It is confined during the breeding season to the extreme southern part of Florida, where it has been known to nest from Indian Key (Audubon); west to Marquesas Key (Fowler); and north to Cape Romano (Scott). It is normally nonmigratory, but a few individuals have wandered north on the east coast of Florida to Brevard County (Chapman); in the interior to Cypress Lake (Palmer); and on the west coast to Anclote River (Scott). South of the United States it has been taken on the Rio Lagartos, Yucatan (Brown), in Jamaica (March), and near Trinidad, Cuba (Chapman). Eggs have been taken on the Florida Keys from October (Scott) all through the winter and spring to the middle of June (Thayer).

Great Blue Heron. *Ardea herodias herodias* Linnæus.

Range.—The great blue heron with its several subspecies ranges from ocean to ocean and north to southern Canada and southern

Alaska. It occurs throughout Mexico, Central America, Bermuda, the Bahamas, and the West Indies, while a few birds have been recorded from northern South America and from the Galapagos Islands.

Breeding range.—The typical form *herodias* breeds north to Baddeck, N. S. (Dwight); Magdalen Islands, Quebec (Job); Chatham, N. B. (Baxter); Quebec City, Canada (Dionne); Cobalt, Ontario (Hubel); Riding Mountain, Manitoba (Seton); Osler, Saskatchewan (Colt); and Spotted Lake, Alberta (Loring). It has been known to occur north to Anticosti (Schmitt); Godbout, Quebec (Comeau); Moose Factory, Ontario (Turner); and Fort Chimo, Quebec (Turner). It breeds south on the Atlantic coast to Mount Pleasant, S. C. (Wayne), and south in the Mississippi Valley to Winnebago County, Iowa (Abbott). It occurs west in migration to Prospect Lake, B. C. (specimen in American Museum of Natural History), and probably breeds in southeastern British Columbia.

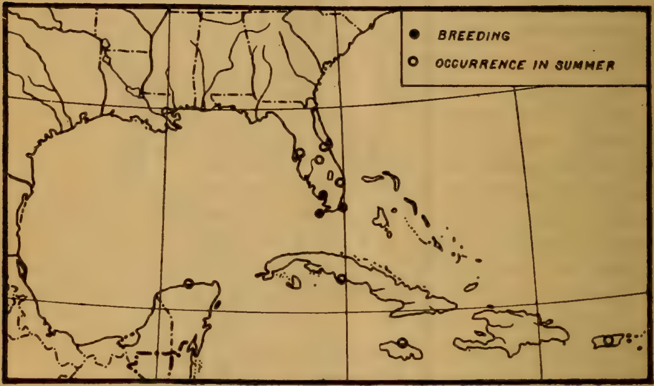

FIG. 12.—Great white heron (*Ardea occidentalis*).

The species once nested in Bermuda in 1846 (Wedderburn), but has since then been known there as a migrant only.

Winter range.—The regular winter range of typical *herodias* extends south to Micco, Fla. (Bangs); Castleberry, Ala. (Matthews); and to Camargo, Tamaulipas (Goldman). The species ranges north in winter to Raleigh, N. C. (Brimley); Cape Charles, Va. (Chapman); and to Fayetteville, Ark. (Harvey). In mild winters some individuals remain much farther north, as far as the lower Ohio Valley (Butler) and New Jersey (Fisher), while stragglers have been noted at Randolph, N. H., December 31, 1910 (Allen); Milton, Vt., December 22, 1884 (Howe); Boston Harbor, Mass., January 1, 1882 (Job); West Roxbury, Mass., January 1, 1890 (Faxon); Point Judith, R. I., December 11, 1899 (Hathaway); Bridgeport, Conn., January 1884 (Foster); Madison County, N. Y., January 12, 1900, and December 27, 1900 (Embody); Frankfort, Ind., January 14, 1903 (Ghere); Lansing, Mich., December 23, 1897 (Hawkinson).

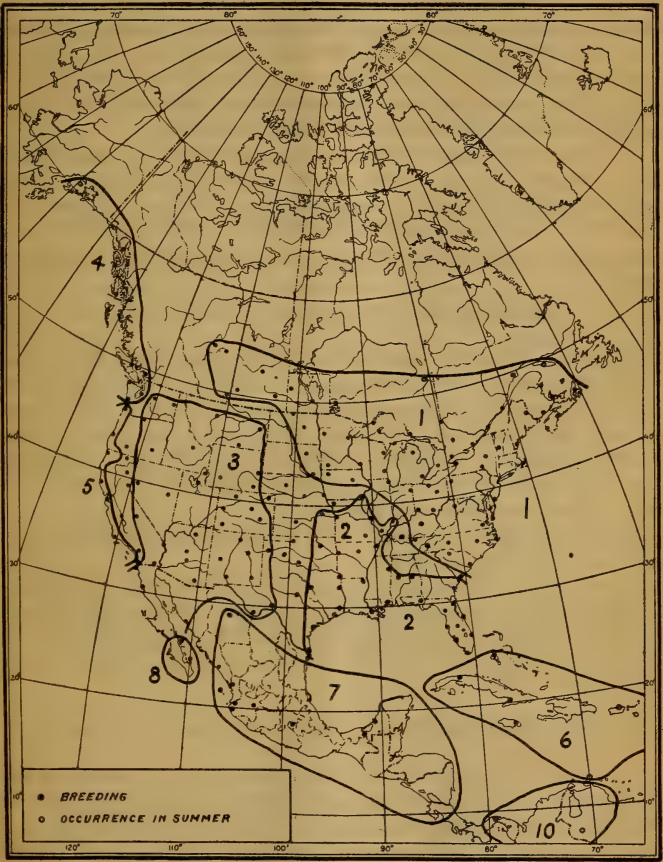
BREEDING
OCCURRENCE IN SUMMER
1
2
3
4
5
6
7
8
10
70°
80°
60°
70°
60°
50°
40°
30°
20°
10°
120°
110°
100°
90°
80°
70°

FIG. 13.—Great blue heron (*Ardea herodias*). Subspecies: 1, *herodias;* 2, *wardi;* 3, *treganzai;* 4, *fannini;* 5, *hyperonca;* 6, *adoxa;* 7, *lessoni;* 8, *sanctilucae;* 9, *cognata* (Galapagos, not shown on map); 10, South American birds not yet determined or named.

Ward Heron. *Ardea herodias wardi* Ridgway.

The form of the great blue heron breeding in Florida has received the name of *wardi*. It includes not only all the Florida breeding birds, but also those breeding on the Atlantic coast north to Hiltonhead, Beaufort County, S. C. (Prentiss); along the Gulf coast to Corpus Christi, Tex. (Sennett); and up the middle of the Mississippi Valley to Knox County in southwestern Indiana (Ridgway); and Henry County in southeastern Iowa (Savage).

This form is resident throughout its range with the exception of those individuals that migrate up the Mississippi Valley. These retire in the fall to spend the winter on the Gulf coast. A specimen taken December 25, 1902, at Ocotlan, Jalisco (Nelson and Goldman), apparently represents a bird that had wandered far from its normal range.

Treganza Heron. *Ardea herodias treganzai* Court.

The large, dark, great blue herons of the Mississippi Valley are cut off from those of the Pacific by a small pale form occupying the Great Basin and the semiarid regions to the eastward. This form has been separated under the name of *treganzai*, and birds of this character breed north at least to Douglas, Wyo. (Dwight); Gallatin, Mont. (Richmond); and Grace, southeastern Idaho (Walcott); and south to the Salton Sea, Cal. (Grinnell).

During migration it spreads westward into California to the Sacramento Valley (Williamson).

It ranges south in winter to the lower Rio Grande Valley of Texas (Dwight); and in northern Mexico south to Colima (Nelson and Goldman); while it remains in winter north to Fort Clark, Tex. (Mearns); Dona Ana, N. Mex. (Henry); and St. George, Utah (Bailey).

Northwestern Coast Heron. *Ardea herodias fannini* Chapman.

As its name implies, the northwestern coast heron is confined to the Pacific coast. It is known to breed north to Glacier Bay, Alaska (Grinnell), and it probably breeds still farther north, for it was seen occasionally during the summer of 1906 near Yakutat Bay (Blackwelder); and at Hope, Cook Inlet, during August, 1900 (Heller). This form breeds south to Cape Flattery, Wash. (Trowbridge); and to Nisqually Flats near Tacoma, Wash. (Rhoads).

Alaska is deserted in winter, and most of the individuals spend this season in the vicinity of Puget Sound north to Chilliwack, B. C. (Brooks).

California Great Blue Heron. *Ardea herodias hyperonca* Oberholser.

The great blue herons of the Pacific coast from Oregon to southern California have lately been segregated by Oberholser under the name of *hyperonca.* A specimen from Oregon (Peale) without any definite locality indicates the probability that the coast-breeding birds of that State should be assigned to this form, and thence it extends south to San Diego, Cal. (Cooper). How far back from the coast this form ranges, and to which form should be assigned the great blue herons of the interior valleys of California are points not yet decided.

West Indian Great Blue Heron. *Ardea herodias adoxa* Oberhholser.

According to Oberholser, who has recently described this form, this subspecies includes all the breeding birds of the entire Greater and Lesser Antilles, with the addition of the Bahamas on the north and Curaçao Island off the coast of Venezuela on the south. A strange fact in the life history of this form is that it is a pronounced migrant. It is known in the winter season as a not rare visitant to the whole Lesser Antilles, but is not known to breed on any of them, nor is it probable that it breeds on either Porto Rico or Haiti. While fairly common in winter on many of the Bahamas, it has not yet been found breeding on any of them, though birds have been noted at what might have been and probably was the breeding season. The species is recorded as more common in Jamaica during the winter than in summer, hence no great numbers probably leave this island.

The status of the birds of the Isle of Pines and of Cuba, in which latter country it is a common breeder, remains entirely unsettled, nor is it known whether they belong to this new form or to *wardi.* The most that can be said at present is that the great blue heron is a winter resident in Haiti, Porto Rico, and the Lesser Antilles south to the islands of Trinidad and Curaçao, but that there is nothing certain known as yet concerning the summer home of these individuals.

Mexican Great Blue Heron. *Ardea herodias lessoni* Wagler.

Many years ago the great blue herons of the mainland of Mexico were named as above and these birds breed in favorable localities over much of Mexico south to Guerrero and east to Campeche. They occur as migrants and winter residents throughout the whole of Central America to central Costa Rica.

The status of the great blue herons of northwestern South America is not yet settled, but the bird occurs in the breeding season from

Merida, Venezuela, to the Canal Zone, Panama, and also winters in this region and on the islands off the north coast of Venezuela.

Lower California Great Blue Heron. *Ardea herodias sanctilucae* Thayer and Bangs.

The name *sanctilucae* applies to the birds of the Cape region of Lower California, where they have been found breeding on San Jose and Espiritu Santo Islands and wintering south to San Jose del Cabo.

Galapagos Great Blue Heron. *Ardea herodias cognata* Bangs.

Restricted to the Galapagos Islands, where it is a constant resident.

Migration and breeding of the Great Blue Heron and its subspecies.

The following records of migration and breeding are not separated according to subspecies, but it is easy to tell from the preceding statements of range which particular form is intended.

Spring migration.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Raleigh, N. C	5	Apr. 2	Rare, winter.
Weaverville, N. C	3	Apr. 6	Mar. 29, 1894
Lick Run, Va	3	Apr. 1	Mar. 27, 1888
White Sulphur Springs, W. Va	4	Apr. 6	Apr. 4, 1898
Washington, D. C	6	Apr. 3	Jan. 21, 1912
Erie, Pa	5	Apr. 5	Mar. 27, 1902
Renovo, Pa	6	Apr. 15	Mar. 24, 1903
Morristown, N. J	4	Apr. 9	Mar. 27, 1886
Branchport, N. Y	12	Mar. 31	Mar. 24, 1899
Canandaigua, N. Y	3	Mar. 25	Mar. 24, 1906
Bridgeport, Conn	4	Apr. 9	Apr. 4, 1905
Hartford, Conn	5	Apr. 11	Apr. 4, 1897
Jewett City, Conn	6	Apr. 12	Mar. 27, 1901
Fitchburg, Mass			Mar. 20, 1898
Framingham, Mass. (near)	5	Apr. 12	Apr. 6, 1887
Southern New Hampshire	9	Apr. 16	Mar. 28, 1908
Plymouth, Me	7	Apr. 11	Apr. 6, 1879
Westbrook, Me	4	Apr. 15	Mar. 24, 1894
Portland, Me	5	Apr. 15	Apr. 9, 1905
Grand Manan, New Brunswick	3	Apr. 8	Apr. 3, 1889
St. John, New Brunswick	5	Apr. 12	Apr. 3, 1892
Scotch Lake, New Brunswick	10	Apr. 11	Mar. 30, 1902
Halifax, Nova Scotia (near)	3	Apr. 17	Mar. 31, 1904
North River, Prince Edward Island	3	Apr. 12	Apr. 8, 1888
Quebec City, Canada	3	Apr. 16	Apr. 14, 1905
Shawneetown, Ill	2	Mar. 9	Mar. 7, 1885
Gilman City, Mo	4	Mar. 18	Mar. 16, 1904
Camden, Ind	4	Mar. 19	Feb. 14, 1885
La Porte, Ind	4	Mar. 29	Mar. 26, 1893
Waterloo, Ind	7	Mar. 30	Mar. 23, 1887
Chicago, Ill	5	Mar. 31	Feb. 28, 1890
Rockford, Ill	6	Mar. 31	Mar. 21, 1893
Youngstown, Ohio			Mar. 12, 1909
Sandusky, Ohio	12	Apr. 1	Mar. 13, 1907
Oberlin, Ohio	8	Apr. 1	Mar. 20, 1897
Detroit, Mich	2	Mar. 13	Mar. 11, 1891
Vicksburg, Mich	6	Mar. 25	Mar. 16, 1908
Petersburg, Mich	7	Mar. 30	Mar. 17, 1897
Plymouth, Mich	5	Apr. 2	Mar. 30, 1897
Plover Mills, Ontario	5	Mar. 31	Mar. 23, 1897
Dunnville, Ontario	4	Apr. 2	Mar. 29, 1897
Guelph, Ontario	6	Apr. 4	Mar. 26, 1902
Toronto, Ontario	4	Apr. 9	Feb. 1, 1891

Spring migration—Continued.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Ottawa, Ontario	15	Apr. 11	Apr. 3, 1909
Sault Ste. Marie, Ontario			Apr. 19, 1884
Hillsboro, Iowa	5	Mar. 25	Mar. 22, 1897
Indianola, Iowa	5	Mar. 26	Mar. 21, 1901
Grinnell, Iowa			Feb. 12, 1890
Laporte, Iowa	5	Mar. 29	Mar. 21, 1886
Madison, Wis. (near)	8	Apr. 9	Apr. 1, 1892
Meridian, Wis.			Apr. 5, 1897
Lake Andrew, Minn.	7	Apr. 3	Mar. 27, 1895
Heron Lake, Minn.	7	Apr. 5	Apr. 1, 1889
Elk River, Minn.	7	Apr. 5	Mar. 21, 1907
White Earth, Minn.			Apr. 14, 1882
Richmond, Kans. (near)	7	Mar. 25	Mar. 17, 1885
Nebraska City, Nebr. (near)	4	Apr. 11	Mar. 21, 1896
Reaburn, Manitoba	5	Apr. 19	Apr. 15, 1902
Indian Head, Saskatchewan	3	May 9	Apr. 20, 1907
Salida, Colo.			Mar. 19, 1909
Denver, Colo. (near)	8	Apr. 2	Mar. 24, 1908
Cheyenne, Wyo.			Apr. 3, 1886
Sheridan, Wyo.			Apr. 13, 1907
Terry, Mont.	4	May 7	May 2, 1905
Brownfield, Alberta			May 7, 1907

In the southern part of the breeding range the time of nesting is variable. Gundlach found eggs in Cuba through all the months from September to January. Eggs were taken on the Galapagos September 2, 1897 (Rothschild and Hartert). The young found February 5, 1910, at Upper Matecumbe Key, Fla. (Brodhead), were hatched from eggs that must have been laid in December, while at Charleston, S. C., Wayne says that the earliest eggs are deposited the middle of March and that eggs are most common in late March. Young were in the nest May 25, 1875, at Cobb Island, Va. (Bailey); eggs at Wilmington, Del., April 29, 1906 (Pennock); Tully, N. Y., April 29, 1884 (Dakin); Penn Yan, N. Y., May 3, 1896 (Burtch); Oneida Lake, N. Y., May 1, 1884 (Northup); Little Spruce Island, Me., May 16, 1896 (Knight); Kentville, N. S., May 10 (Bishop); Camden, Ind., May 21, 1883 (Evermann); New Bremen, Ohio, April 27, 1908 (Henninger); Dorset, Ohio, May 12, 1900 (Keck); Sunfield, Mich., May 2, 1891 (White); Minneapolis, Minn., May 8, 1888 (Morrison); San Jose Island, Lower California, February 15–18, 1909 (Thayer); Refugio County, Tex., late February, 1896 (Strecker); Beaumont, Tex., March 22, 1887 (Rachford); Laramie, Wyo., May 12, 1901 (Gilmore); Terry, Mont., April 23, 1905 (Terry); San Diego, Cal., April 24, 1861 (Cooper); Napa, Cal., April 4, 1901 (Hottel); Malheur Lake, Oreg., April 16, 1875 (Bendire); and Sumner, Wash., April 20, 1905 (Bowles). Young were noted at Isabella Island, Mexico, April 10, 1905 (Bailey); fledged young at Redwood City, Cal., April 14, 1907 (Carriger and Pemberton); and young three weeks old near Salt Lake City, Utah, April 9, 1907 (Treganza).

Fall migration.

Place.	Number of years' records.	Average date of the last one seen.	Latest date of the last one seen.
Flagstaff, Alberta			Sept. 23, 1906
Terry, Mont	2	Sept. 21	Sept. 24, 1905
Littleton, Colo			Nov. 3, 1908
Margaret, Manitoba	3	Sept. 13	Sept. 15, 1910
Sioux Falls, S. Dak	2	Oct. 26	Oct. 31, 1909
Nebraska City, Nebr			Nov. 8, 1909
Lanesboro, Minn	5	Sept. 17	Oct. 1, 1892
Keokuk, Iowa	4	Oct. 10	Nov. 11, 1900
Lake Forest, Ill			Nov. 22, 1906
Ottawa, Ontario	13	Nov. 1	Nov. 17, 1909
Southwestern Ontario	6	Oct. 24	Dec. 1, 1906
Vicksburg, Mich	5	Nov. 2	Nov. 18, 1902
Northern Ohio	4	Nov. 12	Dec. 19, 1910
North River, Prince Edward Island	4	Oct. 16	Oct. 20, 1890
Pictou, Nova Scotia			Oct. 11, 1894
Scotch Lake, New Brunswick	4	Nov. 5	Nov. 8, 1904
St. John, New Brunswick	7	Oct. 14	Oct. 30, 1889
Quebec City, Canada			Oct. 4, 1894
Montreal, Canada	7	Oct. 31	Nov. 13, 1897
Pittsfield, Me	4	Oct. 24	Nov. 13, 1896
Woods Hole, Mass	4	Nov. 1	Nov. 21, 1891
Renovo, Pa	4	Oct. 17	Nov. 10, 1911
Erie, Pa			Nov. 22, 1902
Washington, D. C			Dec. 5, 1894
Weaverville, N. C			Oct. 11, 1890

European Heron. *Ardea cinerea* Linnæus.

The European heron is entitled to a place in the list of North American birds solely on the strength of its occurrence in Greenland, where it has been taken several times. It is recorded from Nanortalik, 1856, Godthaab, 1862, and January 14, 1877, and Nunarsuit, 1888, all these places being on the west coast; from Eggers Island, at the south extremity of Greenland, the fall of 1893; and once from the east coast.

This heron has a wide distribution in the Eastern Hemisphere, ranging north in Europe and Asia to about latitude 60°, and south to southern Africa, Madagascar, southern Asia, the Malay Islands, and Australia.

Egret. *Herodias egretta* (Gmelin).

Range.—The Gulf States and Mexico and north to Oregon, Wisconsin, and New Jersey; the West Indies, Middle and South America to Patagonia; has wandered north to Manitoba and Nova Scotia.

Breeding range.—In the case of the egret a distinction must be made between the present and the former breeding range, because this is one of the species which has been almost exterminated for the sake of obtaining the dorsal plumes known as aigrettes that are borne at the breeding season. Fifty years ago, before the demands of fashion had called for its slaughter, the egret nested in great colonies in Florida, the other Gulf States, and several States of the

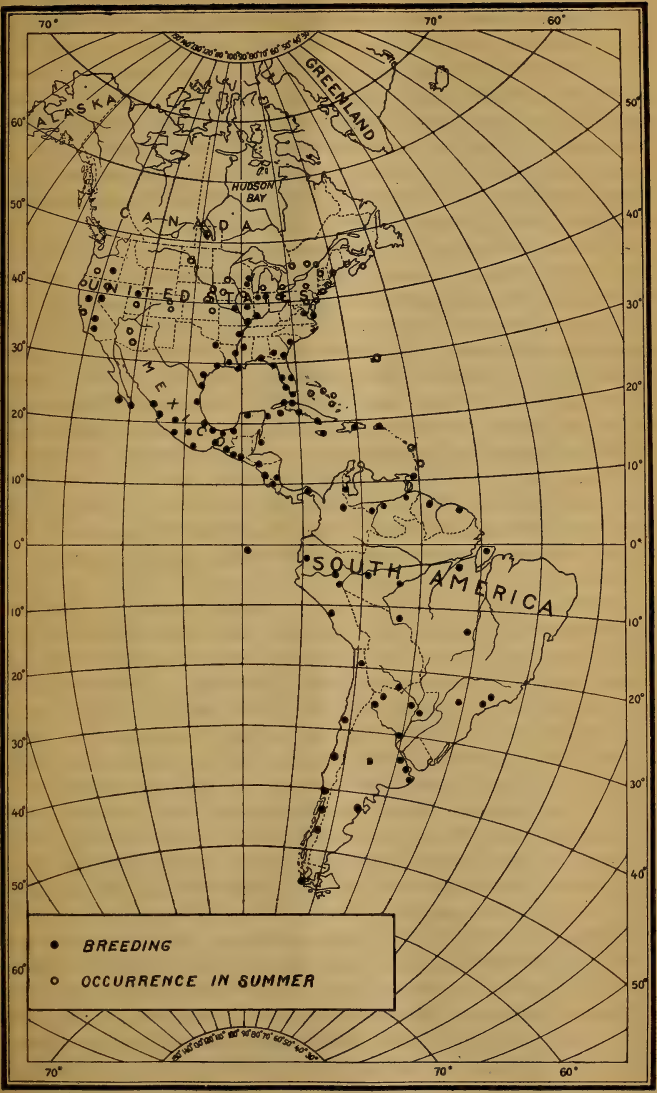
ALASKA
CANADA
GREENLAND
HUDSON BAY
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER
70°
60°
50°
40°
30°
20°
10°
0°

FIG. 14.—Egret (*Herodias egretta*).

Mississippi Valley. The nests were usually placed on large trees growing in water, and hence the colonies were restricted to the heavy swamps near the coast or to the bottom lands of the larger rivers inland. The birds nested commonly north along the Atlantic coast to Charleston, S. C. (Audubon). They undoubtedly nested in some of the many favorable localities on the coasts of North Carolina and Virginia, where actual records are very few, and thence north to southern New Jersey, where in Wilson's time a small colony bred near Cape May. The egret once nested in Arlington Cemetery, Virginia, near Washington, D. C. (Wm. Palmer).

The bottom lands of the Mississippi River and its larger tributaries furnished an abundance of suitable nesting sites, and here were the largest colonies outside of Florida. As many as a thousand birds have been seen in a single colony in Daviess County, Ind. So generally distributed were these herons in Indiana that they have been known to nest in Knox, Gibson, Daviess, Dekalb, Steuben, Noble, Jasper, Porter, Lake, and Starke Counties. The southern third of Indiana marked the northern limit of the larger breeding colonies, but smaller colonies nested north to northern Indiana and even two-thirds of the way up the western shore of Lake Michigan to Two Rivers, Wis. (Kumlein and Hollister). The egret also nested as far north as Grand Ridge, Ill. (Soule); Canton, Ill. (Cobleigh); Lincoln County, Mo. (Widmann); and Texarkana, Tex. (Oberholser).

The Great Plains and the Rocky Mountain region offered little inducement to the egret, and it seems to have been absent during the breeding season from the whole of this great area except that a few nested near Great Salt Lake, Utah (Ridgway). A few small colonies existed in California, at Buena Vista Lake (Linton); Summit Lake (Goldman); and Sacramento (Ridgway); also in the Truckee Valley, Nev. (Ridgway); and north to Malheur Lake, Oreg. (Bendire), which was formerly the home of probably the largest colony on the Pacific slope. Here, contrary to their habit in most parts of their range, the birds were necessarily forced to nest among the reeds.

South of the United States the former breeding range of the egret seems to have included all of Central America and the whole of South America south to Port Otway, Patagonia (Sclater and Salvin). It is to be understood, of course, that the species was very local throughout this whole region, being restricted to the few places favorable for nesting sites situated principally on the coasts, the larger lakes, and the borders of the lower parts of the larger rivers, especially the Parana, the Paraguay, and the upper Orinoco. The egret nested on the four large islands of the Greater Antilles, but seems to have been rare in the West Indies east of

Porto Rico, though recorded from Dominica (Verrill), Barbados (Manning), and Trinidad (Leotaud), and from the islands of New Providence, Andros, Eleuthera, Watlings, and Long, in the Bahamas (Riley). It nested on the Galapagos (Rothschild and Hartert).

Many herons have the strange habit of migrating northward after the breeding season and are often common for several weeks in the fall in districts far north of the breeding range. The egret is a conspicuous example of birds with this habit, and these northward movements in the fall have brought them to many places in Ohio, New York, and New England, and north to Halifax, N. S. (Jones); Grand Manan, N. B. (Deane); Calais, Me. (Boardman), near Portland, Me. (Knight); Godbout, Quebec (Comeau); Montreal, Canada (Wintle); Rockcliffe, Ontario (McIlwraith); Lake Nipissing, Ontario (Seton); Rondeau, Ontario (McIlwraith); Kalamazoo, Mich. (Gibbs); Lanesboro, Minn. (Hvoslef); also northwestward in the Missouri River Valley to Emporia, Kans. (Kellogg); Fairbury, Nebr. (Swenk); Colorado Springs, Colo. (Aiken); Denver, Colo. (Rockwell); Barr, Colo. (Hersey and Rockwell); Badger Lake, Iowa (Lewis and Clark); Fort Lincoln, N. Dak. (Grinnell); and even north to Lake Winnipegosis, Manitoba (Seton).

The above statement represents the range of the egret before the demands of the millinery trade had so woefully depleted its numbers. Now the great colonies are entirely a thing of the past. The plume hunter has made a clean sweep of all the heronries that were large enough to make their exploitation profitable. Nor has the destruction been confined to the birds of the United States. The same story of wholesale slaughter comes from Mexico, Central America, the West Indies, and lastly from South America. It is probable that the largest colonies still in existence are to be found in Venezuela or near the equator, but even in these regions, remote and difficult of access, the high market value of the plumes has proved a sufficient incentive for the overcoming of all hardships, and the colonies remaining are but a small part of the original numbers. A few small colonies still exist in widely separated parts of Florida, where breeding birds have been reported during the last few years from Monroe County (Bent); Kissimmee (Beers); Sebastian (Chapman); Orange Lake (Baynard); and Tallahassee (Williams). The species nested in 1910 near Charleston, S. C. (Wayne); a small flock was seen during the breeding season of 1909 near Ellis Lake, N. C. (Philipp); and a few birds nested in 1911 near Orton, Brunswick County, N. C. (Brimley). It nested in 1908 near the delta of the Mississippi, La. (Bowdish); and there were a few nests in 1910 at Walkers Lake, Ark. (Widmann). On the Pacific slope, the great heronry at Malheur Lake, Oreg., has been wiped out, except a few birds that still lingered in the vicinity in 1911, and the few remaining birds of California are to be found in the vicinity of Tulare Lake (Goldman) and Clear Lake (Finley). Birds still wander north occasionally in the fall and during the last 10 years have been recorded from Eastham, Mass., 1911 (Cobb); Plymouth, Mass., 1911 (Farley); Marshfield, Mass., 1911 (Barrett); East Greenwich, R. I., August 16, 1904 (Allen); Point Judith, R. I., August 2, 1909 (Howe); Connecticut, 1911 (Howes); Montauk, N. Y., July 23, 1900 (Braislin); Ontario County, N. Y., August, 1905 (Reed); East Windham, N. Y., July 18, 1906 (Weber); Ridgwood, N. J., July, 1902 (Hales); Wading River, N. J., August, 1905 (Stone); Englewood, N. J., July 22, 1906 (Lemmon); Black Point, N. J., July 6, 1908 (Howe); Seabright, N. J., August 5, 1908 (Howe); Berwyn, Pa., July 26, 1902 (Burns); Bristol, Pa., July 20, 1906 (Harlow); Ashbourne, Pa., July 30, 1906 (Harlow); Washington, D. C., August 19 to 24, 1912 (Appel); Cincinnati, Ohio, August, 1902 (Stone); West Huron, Ohio, September, 1911 (Klein); Waterloo, Ind., April 22, 1905 (Link); Nehawka, Nebr., May 2, 1905 (Swenk); near Denver, Colo., April 26, 1907 (Rockwell); and Lawen, Oreg., May 5, 1909 (Hibbard).

Winter range.—The egret is resident throughout its range in Central and South America and the Greater Antilles. In the United States it winters in the southern half of Florida north to Gainesville (Chapman); on the coast of Louisiana (Beyer); on the coast of Texas (Audubon); and in southern California north to Santa Cruz (Breninger); and San Rafael (Mailliard). One was taken January 8, 1878, near Fort Klamath, Oreg. (Mearns), but the species does not winter regularly in that locality.

Spring migration.—The egret breeds so little north of its winter home that its regular migrations are short and quickly accomplished. Most of the movements are in March and early April, as shown by the following dates of spring arrival: Cumberland, Ga., March 7, 1902 (Helme); Charleston, S. C., March 28, 1909 (Weston); Rodney, Miss., March 22, 1889, and March 19, 1890 (Mabbett); St. Louis, Mo., April 9, 1886 (Widmann); Canton, Ill., April 11, 1895 (Cobleigh); Bloomington, Ind., April 10, 1887 (Evermann); near Vincennes, Iowa, April 17, 1894 (Currier); Tucson, Ariz., April 23, 1881 (Brewster); Fresno County, Cal., April 5, 1890 (Eaton); and Stockton, Cal., April 1, 1878 (Belding).

The egret breeds through such a wide range of latitude, both north and south of the equator, that it is natural that the nesting dates should show a wide variation. At the south end of the range in Chile and Argentina the height of the nesting season is in October and November; British Guiana, eggs in June (Lloyd); Haiti, February 18, 1895 (Christy); Cuba, March to June (Gundlach); Port

Henderson, Jamaica, June 25, 1890 (Field); Lake Okechobee, Fla., February 4, 1896 (Stone); Gainesville, Fla., June 14, 1893 (specimens in U. S. National Museum); near Charleston, S. C., April 7, 1910 (Wayne); Brownsville, Tex., young half grown May 15, 1877 (Sennett); eggs near Corpus Christi, Tex., April 4, 1882 (specimens in U. S. National Museum); Camp Harney, Oreg., April 16, 1877 (Bendire).

Fall migration.—The northward migration after the close of the breeding season begins in early July, and by the middle of the month the young birds are far north of the home of their birth. These wanderings last for a month to six weeks, and by late August or early September most of the birds have returned to the winter home. Occasionally a few birds remain in the north much later: Stockton, Cal., December 7, 1878 (Belding); near Richmond, Me., August 20, 1896 (Knight); Nantucket, Mass., September 20, 1890 (Mackay); Ipswich, Mass., November 22, 1892 (Vickary); Orleans County, N. Y., November 28, 1883 (Davison); Marcy, N. Y., November 10, 1889 (Ralph and Bagg); Jamaica Bay, N. Y., October 1, 1897 (Braislin); Ocean City, Md., September 23, 1894 (Taylor); and St. Louis, Mo., September 2, 1896 (Widmann).

Snowy Egret. *Egretta candidissima* (Gmelin).

Range.—The Western Hemisphere from Chile and Argentina north to the Gulf States and Mexico; has wandered north to Nova Scotia, Ontario, and British Columbia.

Breeding range.—The snowy egret is another plume bird which, like the larger egret, has been sadly diminished in numbers by the demands of fashion for the beautiful aigrettes that are carried during the breeding season. In fact, the snowy egret has suffered a severer persecution than any other heron and has been practically exterminated over large areas where once it was common. Formerly this species had a wide distribution, breeding abundantly in the Gulf States and commonly along the Atlantic to Charleston, S. C. (Wayne). Smaller colonies occurred on the coast of North Carolina and Virginia, and a large colony near Cape May, N. J., marked the northern limit of the breeding range. This last colony was visited by Wilson in 1812 and found to cover an extensive area. It was still well populated in 1886, but in 1888 only one pair remained, and the explanation was: "They have been almost exterminated, though formerly very abundant, one ornithologist having recently shot 73 birds in one day" (Parker).

Though abundant as a breeder near the mouth of the Mississippi, the snowy egret seems never to have nested in large colonies far back from the coast. In Audubon's time the bird was fairly common north to Memphis, Tenn., but only a few have nested to the northward, and their northern limit seems to have been reached in Knox

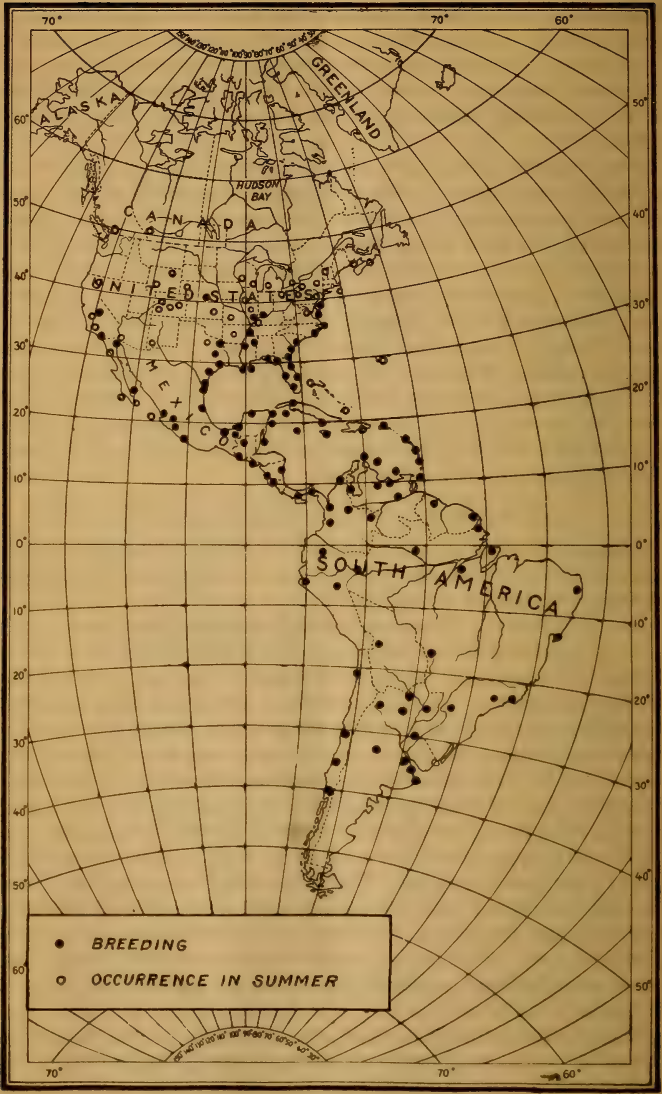
ALASKA
CANADA
GREENLAND
HUDSON BAY
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER

FIG. 15.—Snowy egret (*Egretta candidissima*).

County, Ind. (Ridgway). The nesting of this species, June, 1895, at Lincoln, Nebr. (Eiche), was probably fortuitous.

West of Louisiana numbers of this species become less, though it nested at favorable localities along the whole Texas coast, and there was a large colony near the mouth of the Rio Grande (Merrill); it also nested up some of the larger streams to Tarkington (Gaut) and Texarkana (Oberholser). As a breeder it was absent from the whole Rocky Mountain region and Pacific slope of the United States, the northern limit of the breeding range on the Pacific being found near San Jose Island, Lower California (Brown), and Rosario, Sinaloa (Nelson).

The snowy egret nested on both coasts of Mexico and on the larger interior waters. These breeding haunts were invaded by the plume hunters after the United States birds had been killed off and for several years furnished large shipments of aigrettes. Even as late as 1900 some of these colonies had not yet been destroyed. In the spring of that year, at Paligada, Tabasco, the owner of a tract of land containing a large heronry sold for a thousand dollars the right to shoot them, and the birds were exterminated that season. The breeding range also included the lower parts of Central America and South America, south to Valdivia, Chile (Boeck), and to Cape San Antonio, Argentina (Gibson). The species was also a common breeder in the Greater Antilles and less common in the Lesser Antilles, but seems to have been rare in the Bahamas, being recorded only from Inagua (Cory) and Great Bahama (Cory), while only a few specimens have been taken in Bermuda at the times of spring and fall migration.

The snowy egret has the same habit as the larger egret (*Herodias egretta*) of migrating north of the breeding grounds, though the number of such migrants has not been so great nor have the wanderings been so extensive as in the case of the larger relative. There are some half dozen records for Long Island, N. Y. (Braislin), and one for Buffalo, N. Y. (Eaton). The species is recorded from Stratford, Hartford, Saybrook, and Groton Long Point, Conn. (Merriam); Nantucket, Mass., March, 1882 (Purdie); St. Albans, Vt., October, 1890 (Howe); Grand Manan, N. B. (Boardman); near Halifax, N. S., 1868, and Windsor, N. S., 1872 (Downs); in each of the counties in Ohio along Lake Erie (Jones); Dunnville and Long Point, Ontario (McIlwraith); Keokuk, Iowa (Praeger); Des Moines, Iowa (Keyes); Lake Koskonong, Wis., August, 1886 (Skavlem); Topeka, Kans., August 15, 1872 (Prentice); Fremont, Nebr., September 4, 1893 (Trostler); near Laramie, Wyo., early May, 1902 (Knight); Buffalo, Wyo., about April 11, 1904 (Felger); near Calgary, Alberta, May 11, 1901 (Dippie); Burrard Inlet, B. C., May, 1879 (Fannin).

It will be noticed that many of these are spring records, and they differ from those of the larger egret in representing the wandering of adult birds rather than of newly fledged young. The same thing is shown still more strongly by the Colorado records. More than 50 instances of the occurrence of the bird in the State are on record, showing that it is a regular visitant, and nearly half are in the spring—earliest April 15, 1906, near Nucla (Warren)—and the remainder at intervals through the season to October 4, 1897, the latest at Pueblo (Doertenbach). Yet the bird is not known to nest in Colorado and probably does not breed anywhere within 500 miles of the State. The same conditions occur in California, where at Stockton the bird was found common in 1878 from March 6 to November 20 (Belding), yet did not nest. Thus it seems that in the case of the snowy egret many adult birds went north at the time of the spring migration far beyond the regular breeding range of the species and spent the summer there as nonbreeders. This species is an exception to the general rule that "all birds breed at the northern limit of their range." This remaining of nonbreeders throughout the summer north of their breeding range is just the opposite of what happens among the shore birds, many of which remain as nonbreeders all summer far south of the breeding range.

The snowy egret produces plumes selling for more than their weight in gold, and consequently the birds have been persistently persecuted until in the United States they have reached the verge of extinction. A few small colonies still remain, however, to serve as centers of distribution now that better laws and a better public sentiment in favor of bird protection bid fair to allow this beautiful species a chance to reoccupy its former range. Within late years the birds have been known to breed in Florida, near Cape Sable, in 1903 (Bent); Charleston, S. C., 1910 (Wayne); on the Audubon bird reservation at the mouth of the Mississippi River, La., 1908 (Kopman); the species probably nested in 1909 near Beaufort, N. C., where they were seen June 23 (Bowdish); and a few nested in 1911 near Orton, Brunswick County, N. C. (Brimley). The largest colony now existing in the United States is on the great bird refuge of Avery Island, La., where in 1910 it was estimated that fully 2,000 pairs were nesting (Ward). Some other late records of migrants or wanderers have been made near Deming, N. Mex., November 5, 1906 (Munson); Sapillo Creek, N. Mex., October 21, 1908 (Bergtold); Delair, N. J., July 16, 1904 (Miller); and San Quintin Bay, Lower California, April, 1910 (Howell).

Winter range.—The snowy egret remained throughout the winter in full numbers in southern Florida, but from central Florida northward most of the birds retired during the cold season. A few were found in winter at Anclote Keys, Fla. (Scott); Gainesville, Fla.

(Chapman); and at St. Marys, Ga. (Helme); while in Audubon's time a few wintered as far north as Charleston, S. C. The birds winter rarely on the coast of Louisiana (Beyer), but, even in the early days when they were abundant, only a few remained through the winter near Galveston, Tex. (Audubon), or even as far south as Brownsville, Tex. (Merrill). In western Mexico the snowy egret is resident as far north as it breeds, and seems to be nonmigratory throughout all of its range in Central and South America.

Spring migration.—The northward movement began in early March: Cumberland, Ga., March 7, 1902 (Helme); Warrington, Fla., March 22, 1885 (Stone); Frogmore, S. C., average date of arrival for five years March 23, earliest March 22, 1889 (Hoxie); southern New Jersey, arrived in early May (Audubon); Rodney, Miss., April 18, 1887, April 13, 1888 (Mabbett).

The nesting season is exceedingly variable in different parts of the extensive breeding range; in the extreme south, at Buenos Aires, Argentina, eggs are laid in November (Gibson); Man-o'-war Cay, British Honduras, young nearly grown May 8, 1862 (Salvin); Cuba, nests from June to October (Gundlach); Tarpon Springs, Fla., eggs August 26, 1886 (Scott); Charlotte Harbor, Fla., May 6, 1886 (Scott); Kissimmee Lake, Fla., April 19, 1908 (Nicholson); Charleston, S. C., April 27, 1910 (Wayne); Cape May, N. J., May 19, 1812 (Wilson); Louisiana, eggs April 10 to June (Baird, Brewer, and Ridgway); Brownsville, Tex., young just hatched May 15, 1877 (Sennett); San Jose Island, Lower California, eggs June 19–24, 1908 (Thayer).

Fall migration.—The presence of nonbreeding birds throughout the summer north of the normal breeding range obscures the records of the northward migration of the young birds in the fall, but this seems to have taken place in July, as in the other species of herons, but never to have been on a large scale. The Long Island records occur from July 1 to August 4 (Braislin); latest in Maryland at Marlboro, August 25, 1893 (Kirkwood); Frogmore, S. C., October 4, 1886 (Hoxie); Canadian River, Okla., still common September 3 to 5, 1820 (Long).

Reddish Egret. *Dichromanassa rufescens* (Gmelin).

The range of the reddish egret extends from the Gulf States to Mexico, the Bahamas, and the Greater Antilles.

This bird is more restricted than most of the herons in its breeding range, which includes Florida north to Pelican Island (Bryant); and lower Suwanee River (Brewster and Chapman); the coast of Louisiana (Beyer); Corpus Christi, Tex. (Sennett); and Brownsville, Tex. (Merrill). It breeds somewhat commonly in the Bahamas from Great Bahama (Cory) and Abaco (Ridgway) on the north to Caicos (Cory) on the south; is rare in Cuba (Gundlach), and is recorded from Jamaica (March) and Haiti (Cory). It breeds at San Jose Island, Lower California (Brown); near San Blas, Tepic (Nelson); and on the coast and islands of Yucatan (Salvin, Lawrence, and Nelson). It has been taken at Chiapam, Guatemala (Salvin); and at Tehauntepec, Oaxaca (Sumichrast); and, as the species is largely nonmigratory, probably it breeds at or near both these localities.

A few instances have been noted of the wandering of the reddish egret north of its breeding range. Several were seen in August, 1875, near Cairo, Ill. (Nelson); one was taken near Colorado Springs, Colo. (Aiken); and one near Golden, Colo. (Berthoud); and several were seen at San Quintin, Lower California (Anthony).

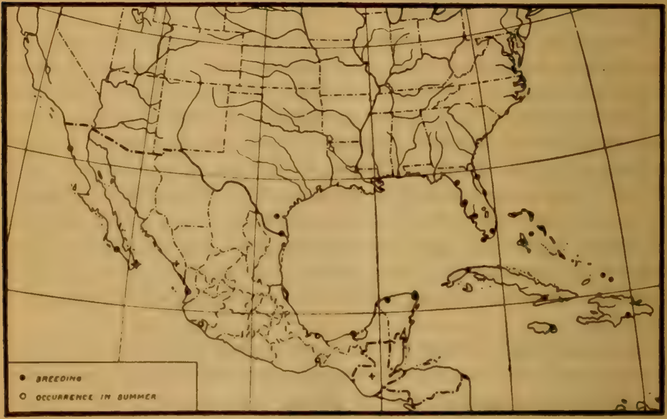

FIG. 16.—Reddish egret (*Dichromanassa rufescens*).

It is partially migratory along the north limit of the breeding range, and few, if any, remain in Louisiana through the whole of the winter, but the species does winter in southern Florida (Scott) and in Mexico as far north as Mazatlan, Sinaloa (Lawrence), and La Paz, Lower California (Belding).

Eggs were found near Corpus Christi, Tex., March 24, 1878 (Sennett); young in the nest, May 3, 1890, at Captive Pass, Fla. (Jamison); and young on the wing, April 15, 1901, Cozumel Island, Yucatan (Nelson). Gundlach says that in Cuba it nests from July to October.

Louisiana Heron. *Hydranassa tricolor ruficollis* (Gosse).

The Louisiana heron, as a whole, ranges from the Gulf States and Mexico south to northern South America. It has been separated into two subspecies, of which the northern, *ruficollis*, extends north to North Carolina, Texas, and central Mexico, and south throughout the Bahamas, the Greater Antilles, and Middle America to Ecuador and Venezuela.

The principal breeding range of the Louisiana heron in the United States is found in Florida and along the Gulf coast to Texas. On the Atlantic coast it is common north to Charleston, S. C. (Wayne), and in Audubon's time it was considered abundant on the coast of North Carolina, where it was still not uncommon near Beaufort in 1898 (Pearson), and nested commonly near Orton, Brunswick County, in 1911 (Brimley). This seems to be the northern limit of the breeding range.

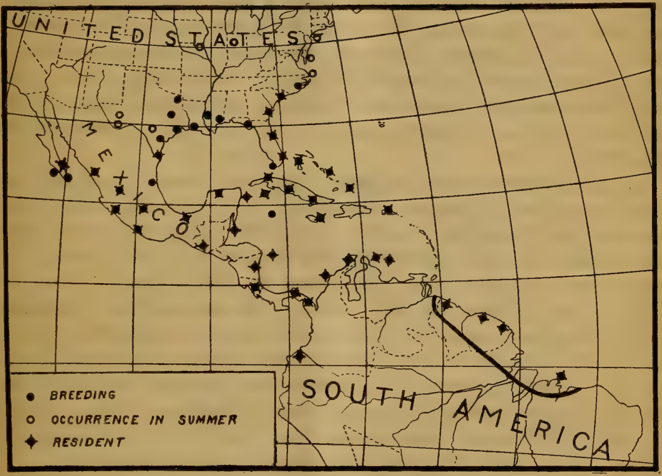

FIG. 17.—Louisiana heron (*Hydranassa tricolor ruficollis*).

In the Mississippi Valley it has nested north to Rodney, Miss. (Mabbett); and Texarkana, Tex. (Oberholser). It seldom wanders far north of its breeding ground, but a few have been noted at Cobb Island, Va. (Ridgway); Patchogue, N. Y., the summer of 1836 (Giraud); Sand Ridge, Clark County, Mo., April 13, 1890 (Currier); near Hanna, Ind., June 26, 1876 (Nelson); Stockton, Tex. (Dresser); and Terlingua, Tex. (Oberholser).

The Louisiana heron breeds along the whole eastern coast of Mexico and north on the west coast to Mazatlan, Sinaloa (Lawrence); La Paz, Lower California (Belding); and Santa Margarita Island, Lower California (Bryant). It breeds south throughout Central America to the Rio Sabana, Panama (Salvadori and Festa); Don Diego, Santa Marta, Colombia (Allen); the islands of Aruba and Margarita, off the coast of Venezuela (Cory); and to Vaqueria in northwestern Ecuador (Hellmayr). It is one of the commoner herons in the Bahamas north to Berry Island (Cory); abundant in Cuba (Gundlach); abundant in Jamaica (Field); and in Porto Rico (Gundlach).

The Louisiana heron is only partially migratory. While many of the most northern breeding birds retire a short distance southward in winter, a few remain at this season at Charleston, S. C. (Wayne); Matamoras, Tamaulipas (Phillips); Mazatlan, Sinaloa (Lawrence); and La Paz, Lower California (Belding). On the other hand, it is stated that the birds do not winter in Louisiana (Beyer, Allison, and Kopman) nor on the Texas coast, even as far south as Brownsville (Merrill).

Young have been taken in June in Jamaica (Scott); and eggs in Cuba from June to October (Gundlach); young a quarter grown at Brownsville, Tex., May 15, 1877 (Sennett); eggs at Nassau, Bahamas, May 17, 1902 (Bonhote); Old Tampa Bay, Fla., March 15, 1880 (Scott); Sarasota Bay, Fla., March 30, 1874 (Bryant); Tarpon Springs, Fla., August 26, 1886 (Scott); Micanopy, Fla., December 8, 1859 (specimens in U. S. National Museum); Charleston, S. C., April 7, 1910, two weeks earlier than usual (Wayne); Rodney, Miss., April 16, 1888 (Mabbett). At places where the birds do not winter the first arrived in the spring as follows: Tallahassee, Fla., March 25, 1901 (Williams); New Orleans, La., March 11, 1894 (Beyer); Rodney, Miss., March 23, 1889, and March 21, 1890 (Mabbett).

Demi-Egret. *Hydranassa tricolor tricolor* (Muller).

The typical form, *tricolor*, is restricted to the Guianas and Brazil, occurring in the latter country south to Cajutuba and Garape (Pelzeln).

Little Blue Heron. *Florida caerulea* (Linnæus).

The little blue heron is common throughout tropical America, breeding north to South Carolina (formerly to New Jersey), Arkansas, and central Mexico, and south to Argentina and Peru; has wandered to Nova Scotia, Wisconsin, and Nebraska.

The little blue heron is one of the commoner herons now found in the southern United States, and is most common in Florida and in the immediate vicinity of the Gulf coast, thence to Texas. Along

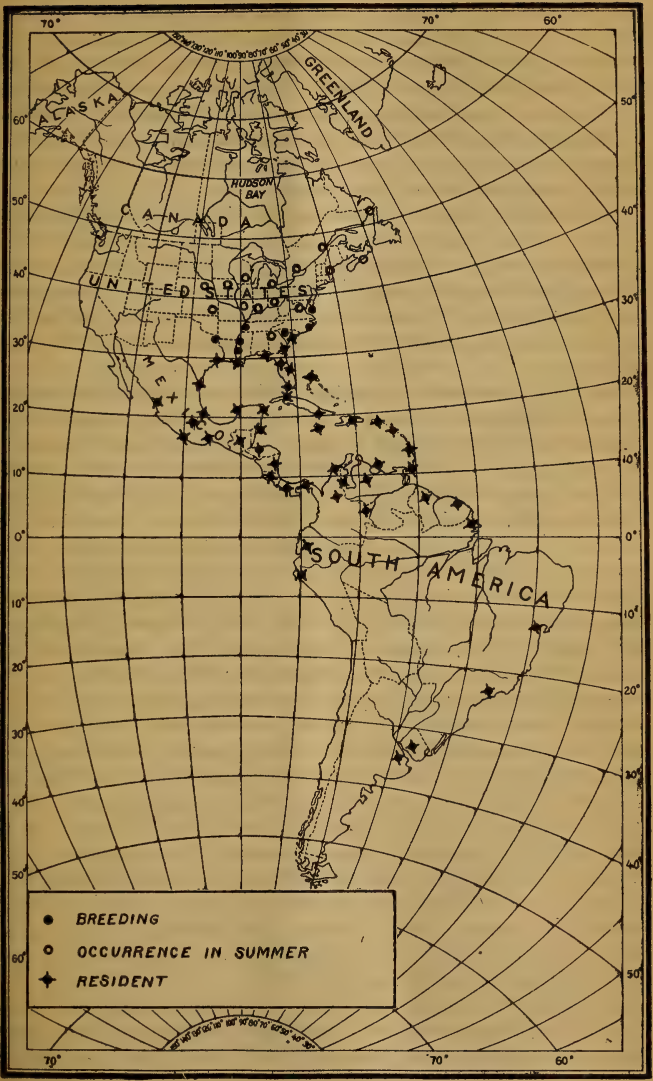
ALASKA
CANADA
HUDSON BAY
GREENLAND
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER
✦ RESIDENT

FIG. 18.—Little blue heron (*Florida caerulea*).

the Atlantic coast the bird breeds commonly as far north as Charleston, S. C. (Wayne), Orton, Brunswick County, N. C., 1911 (Brimley), and used to be common as a breeder even to Currituck Sound, N. C. (White). In Wilson's time a few nested near Cape May, N. J. This heron penetrated inland to breed to a greater extent than many of the species and has been known to nest near Chester, S. C. (Loomis); Greensboro, Ala. (Avery); on the Mississippi River as far north as Osceola, Ark. (Richardon); and in Texas as far as Texarkana (Oberholser), and Long Lake (Oberholser).

The breeding range extends along the eastern coast of Mexico and on the western coast north to San Blas, Tepic (Nelson); thence throughout Central America and northern South America south to Santa Elena, Uruguay (Aplin); Mercedes, Argentina (Burmeister); and Tumbez, Peru (Taczanowski); also in the whole of the West Indies and in the northern Bahamas, Andros, and New Providence (Cory).

The little blue heron is another of the species that has the habit of wandering north in fall far beyond the breeding range. At this season it is tolerably common along the Potomac near Washington, D. C., from July 7, 1894 (Richmond) to September 24, 1911 (Preble), and has occurred north nearly to Baltimore, Md., October 7, 1892 (Fisher); Maplewood, N. J., July 27, 1897 (Owen); Seaford, N. Y., August 13, 1902 (Braislin); Old Lyme, Conn., July 21, 1899 (Brockway); Saybrook, Conn., August 12, 1881 (Clark); Warwick, R. I., July 13, 1878 (Deane); Stoughton, Mass., August 22, 1908 (McKechnie); Amherst, N. H., April 28, 1897 (Melzer); Vinalhaven, Me., April 1, 1902 (Arey); Whitneyville, Me., August 16, 1906 (Knight); Scarborough, Me., September, 1881 (Brown); once in Nova Scotia (Downs); L'Anse au Loup, Quebec, May 23, 1900 (Bangs); near Quebec City, Canada, October, 1881 (Dionne); abundant in southeastern Missouri July to September (Widmann); Seymour, Ind., October 8, 1911 (Peter); Loramie Reservoir, Ohio, July 16, 1909 (Henninger); near Oberlin, Ohio, one about 1882 (McCormick); Aylmer, Ontario, August 15, 1901 (Ames); Detroit, Mich., May 2, 1882 (Taverner); Racine County, Wis., August 28, 1848 (Hoy); Cedar Rapids, Iowa, fall 1903 (Berry); near Omaha, Nebr., August 15, 1903 (Trostler); Neosho Falls, Kans. (Goss); Howard Creek, Tex., August, 1902 (Hollister); and Montrose, Colo., September 14, 1910 (Walker). In Bermuda it has been taken in April, May, September, and October (Hurdis).

The little blue heron was found building in April on Tobago Island, West Indies (Jardine); eggs have been taken in Porto Rico, May to July (Gundlach); Grenada, West Indies, April 14 to June 21

(Oates); Jamaica, June 3 to July 8, 1890 (Field); Cuba, May to July (Gundlach); Alachua County, Fla., April 8, 1890 (Pearson); Tarpon Springs, Fla., August 26, 1886 (Scott); Charleston, S. C., April 7, 1910, much earlier than usual (Wayne); Avery Island, La., May 4, 1895 (Knight); Corpus Christi, Tex., June 12, 1884 (specimens in U. S. National Museum).

Winter range.—This species remains in winter throughout the larger part of its coastal breeding range in the United States, staying north regularly and commonly as far as Charleston, S. C. (Wayne), and a few on Currituck Sound (McAtee). It is not rare in winter on the coasts of Louisiana and Texas (McAtee), though the larger part of the breeding birds in all the above-mentioned places retire farther south for the winter. The winter range on the Pacific coast of Mexico includes the district north to Ocotlan, Jalisco (Goldman), and to Mazatlan, Sinaloa (Lawrence).

Spring migration.—The arrival of the species in the spring was noted at Whitfield, Fla., March 21, 1903 (Worthington); Chipley, Fla., March 12, 1903 (Pleas); Cumberland, Ga., March 8, 1902 (Helme); Frogmore, S. C., average of four years March 31, earliest March 22, 1886 (Hoxie); New Orleans, La., average March 13, earliest March 11, 1894 (Beyer); Bay St. Louis, Miss., March 13, 1902 (Allison); St. Louis, Mo., April 30, 1880 (Hurter); and Bicknell, Ind., April 18, 1896 (Chansler).

The last two dates, taken in connection with several others already given, show that a few little blue herons migrate or wander north in the spring beyond the normal breeding range, but there are no dates to indicate that such birds remain the rest of the summer in the north as nonbreeders, and probably they soon return southward.

The birds of the southern part of the range have been separated as the subspecies *cærulescens* (Latham), which includes all of South America and parts of the Antilles and Central America. The dividing line between these two forms is not yet definitely known.

[Zeledon Boatbill. *Cochlearius zeledoni* (Ridgway).

The Zeledon boatbill occupies nearly the whole of Mexico and Central America from Sinaloa (Mazatlan), Tamaulipas (Alta Mira), and Yucatan (Cozumel Island), south and east to Porto Bello, Panama (Goldman).]

[Pileated Heron. *Pilherodius pileatus* (Boddaert).

This heron is a South American species that was once taken 50 years ago along the line of the Panama Railroad (Lawrence). Since it has not been noted by the many collectors who have visited Panama in the last few years, it is probably now extinct in that country. The range in South America extends south to Peru (Pebas, Santa Cruz, and Nauta) and to Sao Paulo, Brazil.]

Green Heron. *Butorides virescens virescens* (Linnæus).

Range.—The green herons as a whole include several forms which range over most of the United States, all of Mexico, Central America, and the West Indies, and in South America are found in northeastern Colombia, northern Venezuela, and northeastern Brazil.

Breeding range.—The typical form, true *virescens*, breeds north to St. John, New Brunswick (Chamberlain); Montreal, Canada (Wintle); Loughboro Lake, Ontario (Clarke); Guelph, Ontario (Klugh); Kelley Brook, Wis. (Shoenebeck); Minneapolis, Minn. (Grant); and Vermilion, S. Dak. (Agersborg). In the west the species seems to be absent as a breeder from the western part of the plains and the whole of the middle and northern Rocky Mountains. The breeding range extends westward to about the ninety-ninth merdian, except in the Rio Grande Valley, up which the species ranges to the Rio Conchas (J. W. Audubon). The birds have wandered north in summer to Prospect, Nova Scotia (Downs), and on April 15, 1881, after a storm, they were actually common at Westport, Nova Scotia (Chamberlain). They have also been seen north to Ottawa, Ontario (White); Neebish Island, Mich. (Boies); Fort Sisseton, S. Dak (McChesney); and west to Loveland, Colo., July 23, 1895 (Preble); Rinconada, N. Mex. (Surber); and Pecos City, Tex. (Donald).

The breeding range extends south to include the whole of Florida and the Gulf States, eastern Texas, the eastern coast of Mexico, the whole of southern Mexico, Yucatan, and south to Duenas, Guatemala (Salvin and Sclater), and east to Ceiba, Honduras (Bangs). The species breeds also on the west coast of Mexico north to Tepic (Nelson and Goldman).

Winter range.—The green heron winters throughout its range in Mexico and Central America, but no migrating birds from the United States seem to pass any farther south in winter than the region inhabited by the species in summer. Not even in Cuba or the Bahamas has the form of the green heron breeding in Florida and the eastern United States been as yet detected. Since the species is very rare in winter in southern Florida and southern Texas and is absent at this season from the rest of the Gulf States, it follows that nearly all of the tens of thousands of green herons that breed in the eastern United States must reach a winter home in Yucatan and southward by a direct flight across the Gulf of Mexico. The species has been noted in winter north to Gainesville, Fla. (Chapman); Sarasota Bay, Fla. (Bryant); Capers Island, S. C. (Wayne); and Brownsville, Tex. (Merrill).

Spring migration.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Central Florida	5	Mar. 17	Feb. 8, 1905
St. Marys, Ga. (near)	3	Mar. 23	Feb. 8, 1902
College Park, Ga	....	....	Mar. 23, 1906
Frogmore, S. C	6	Mar. 26	Mar. 21, 1889
Raleigh, N. C	12	Apr. 7	Mar. 29, 1893
Weaverville, N. C	4	Apr. 20	Apr. 10, 1891
White Sulphur Springs, W. Va	6	Apr. 23	Apr. 14, 1892
Washington, D. C	11	Apr. 19	Apr. 9. 1905
Waynesboro, Pa	5	Apr. 21	Apr. 17, 1896
Philadelphia, Pa. (near)	8	Apr. 24	Apr. 16, 1884
Renovo, Pa	10	May 7	Apr. 24, 1899
Morristown, N. J	4	Apr. 25	Apr. 18, 1909
New Providence, N. J	10	Apr. 30	Apr. 23, 1893
Ithaca, N. Y	2	Apr. 20	Apr. 18, 1906
New York, N. Y. (near)	9	May 4	Apr. 24, 1890
Branchport, N. Y	10	May 1	Apr. 21, 1900
Ballston Spa, N. Y	4	May 8	May 7, 1890
New Haven, Conn. (near)	5	Apr. 29	Apr. 27, 1886
Hartford, Conn. (near)	5	Apr. 28	Apr. 26, 1896
Providence, R. I	9	May 5	Apr. 25, 1899
Fitchburg, Mass	6	May 7	May 5, 1907
Needham, Mass	....	....	Apr. 9, 1905
Randolph, Vt	....	....	May 7, 1887
Portland, Me	....	....	Apr. 25, 1905
Montreal, Canada	....	....	Apr. 30, 1895
New Orleans, La	....	....	Mar. 21, 1894
Rodney, Miss. (near)	3	Apr. 10	Mar. 26, 1889
Athens, Tenn	....	....	Mar. 30, 1904
Lexington, Ky	5	Apr. 20	Apr. 11, 1904
Monteer, Mo	3	Apr. 23	Apr. 10, 1905
Iberia, Mo	4	Apr. 30	Apr. 27, 1905
St. Louis, Mo	3	May 2	Apr. 17, 1886
Bloomington, Ind	7	Apr. 19	Apr. 10, 1903
Terre Haute, Ind	4	Apr. 20	Apr. 13, 1889
Greencastle, Ind	5	Apr. 21	Apr. 16, 1894
Brookville, Ind	6	Apr. 21	Apr. 17, 1888
Fort Wayne, Ind	5	Apr. 24	Apr. 22, 1909
Waterloo, Ind. (near)	9	May 2	Apr. 13, 1905
Delaware, Ohio	4	Apr. 25	Apr. 21, 1906
Youngstown, Ohio	5	Apr. 25	Apr. 21, 1906
Oberlin, Ohio	14	Apr. 26	Apr. 14, 1899
Vicksburg, Mich	3	May 6	Apr. 25, 1908
Guelph, Ontario (near)	5	May 14	May 11, 1900
Keokuk, Iowa	10	May 1	Apr. 21, 1893
Iowa City, Iowa	8	May 1	Apr. 24, 1891
Laporte, Iowa	5	Apr. 28	Apr. 24, 1884
Chicago, Ill	12	Apr. 28	Apr. 11, 1908
Delavan, Wis	....	....	Apr. 20, 1896
Madison, Wis. (near)	7	May 5	Apr. 26, 1901
Lanesboro, Minn	5	May 4	Apr. 23, 1885
Beaumont, Tex	....	....	Apr. 4, 1887
Kerrville, Tex	7	Apr. 20	Apr. 7, 1906
Manhattan, Kans	5	Apr. 25	Apr. 16, 1883
Onaga, Kans	8	May 7	Apr. 21, 1904
Southeastern Nebraska	8	Apr. 30	Apr. 15, 1899

Eggs have been found at Manatee River, British Honduras, April 21, 1906 (Thayer); Sarasota Bay, Fla., April 18 to June 1 (Bryant); near Orange Hammock, Fla., March 23, 1895, well incubated (Palmer); Frogmore, S. C., April 13, 1870, and June 11, 1886 (Hoxie); Chatham County, N. C., April 20, 1886 (Brooks); Baltimore, Md., April 22, 1881, to June 12, 1894 (Kirkwood); Holland Patent, N. Y., May 16, 1890 (Williams); Canaan, Conn., May 15, 1886 (Tobey); Sunapee, N. H., June 16, 1886 (Bowles); Avery Island, La., April 9, 1893 (specimens in U. S. National Museum); Bernadotte, Ill., May 5, 1891 (Knight); Bloomington, Ind., May 11, 1903 (McAtee);

Sedan, Ind., May 14, 1897 (Hine); Philo, Ill., May 21, 1905 (Hess); Polo, Ill., May 25, 1884 (Kline); Seneca County, Ohio, May 10, 1904 (Henninger); Vicksburg, Mich., June 1, 1904 (Rapp); Charleston Lake, Ontario, June 14, 1899 (Clarke); Davenport, Iowa, May 7, 1892 (Wilson); Brownsville, Tex., May 2, 1877 (specimens in U. S. National Museum); Manhattan, Kans., May 13, 1884 (Lantz); Peru, Nebr., June 2, 1882 (Taylor and Van Vleet).

Fall migration.

Place.	Number of years' records.	Average date of the last one seen.	Latest date of the last one seen.
Montreal, Canada	2	Sept. 1	Sept. 2, 1897
Pittsfield, Me	3	Sept. 21	Oct. 2, 1898
Southwestern Ontario	3	Sept. 18	Sept. 22, 1909
Southern Michigan	8	Sept. 19	Oct. 4, 1903
Madison, Wis			Sept. 14, 1910
Lanesboro, Minn	4	Sept. 13	Sept. 25, 1891
Dunbar, Nebr			Sept. 24, 1904
Onaga, Kans	8	Sept. 16	Oct. 5, 1909
Bonham, Tex			Sept. 20, 1889
Southern Iowa	4	Sept. 24	Oct. 17, 1897
Chicago, Ill			Sept. 22, 1907
Greensburg, Ind			Oct. 7, 1894
Waterloo, Ind. (near)	4	Sept. 19	Sept. 30, 1905
Waverly, Ohio			Oct. 1, 1898
Oberlin, Ohio			Nov. 13, 1897
Athens, Tenn			Oct. 10, 1902
Durham, N. H			Oct. 13, 1900
North Truro, Mass			Oct. 5, 1889
Providence, R. I	9	Sept. 15	Sept. 29, 1897
Hartford, Conn. (near)	5	Sept. 11	Oct. 1, 1894
Central New York	12	Sept. 19	Oct. 2, 1902
Morristown, N. J	4	Sept. 17	Oct. 2, 1905
New Providence, N. J	4	Sept. 17	Oct. 10, 1894
Beaver, Pa	3	Sept. 21	Sept. 25, 1907
Renovo, Pa	6	Sept. 21	Oct. 14, 1909
Washington, D. C	5	Aug. 27	Oct. 2, 1910
Weaverville, N. C			Oct. 10, 1891
Frogmore, S. C			Oct. 4, 1886
St. Marys, Ga			Oct. 24, 1905
Orlando, Fla			Nov. 18, 1885

Anthony Green Heron. *Butorides virescens anthonyi* (Mearns).

The breeding range of the Anthony green heron extends north to Ukiah, Cal. (McGregor), and to Colusa, Cal. (Hollister). The species has wandered north to Yreka, Cal., August 20, 1883 (Townsend), and to Fort Klamath, Oreg., May 4, 1887 (Merrill). It breeds south as far as the Coronados Islands, Lower California (Anthony), Yuma, Ariz. (Coues), and Tombstone, Ariz. (Willard), and northeast to Big Sandy, Ariz. (Stephens), and Camp Verde, Ariz. (Mearns).

It winters in Mexico from Ocotlan, Jalisco (Nelson and Goldman), and the Valley of Mexico (specimen in U. S. National Museum) south to Zamora, Michoacan (Nelson and Goldman), and to Tehuantepec, Oaxaca (Lawrence).

In migration it occurs at San Jose del Cabo, Lower California (Brewster), and Victoria, Tamaulipas (Sennett). A specimen taken November 27, 1896, at San Jose, Costa Rica, is undistinguishable from the Mexican bird.

In spring migration the earliest appearance at Tombstone, Ariz., was on April 22, 1909 (Willard); Sebastopol, Cal., March 12, 1885 (Belding); Stockton, Cal., average April 9, earliest April 4, 1885 (Belding). Eggs are in the U. S. National Museum that were taken May 24, 1890, at Silver Lake, near Tucson, Ariz., and eggs were taken on the Sespe River, Ventura County, Cal., May 12, 1910 (Peyton).

Frazar Green Heron. *Butorides virescens frazari* (Brewster).

The Frazar green heron is restricted to the southern end of Lower California, where it is resident at La Paz, in the region around Magdalena Bay and north to San Ignacio (Nelson and Goldman). Eggs were taken near La Paz May 8 to 26, 1910 (Thayer).

Green Heron. *Butorides virescens* (subspp.).

The two forms of the green heron *virescens* and *anthonyi* are the only ones that occur in the United States. These two forms include the migratory green herons, which have a wide range and perform migrations extending often more than a thousand miles. In southern Central America, northern South America, and throughout the whole of the West Indies the green herons seem to be strictly resident, and as a consequence they have become modified into a large number of local forms or subspecies.

Mr. H. C. Oberholser has recently made an extended study of the green herons, and his conclusions as to the ranges of the various forms are given below:

Chihuahua Green Heron, *Butorides virescens eremonomus* Oberholser. Chihuahua and Durango, Mexico, in summer; south to Michoacan, Mexico, in winter.

Nicaragua Green Heron, *Butorides virescens mesatus* Oberholser. Western Nicaragua.

Panama Green Heron, *Butorides virescens hypernoteus* Oberholser. Costa Rica, Panama, and northern South America, south to Medellin, Colombia, and Para, Brazil.

Swan Island Green Heron, *Butorides virescens saturatus* Ridgway. Swan Island, Caribbean Sea.

San Miguel Green Heron, *Butorides virescens margaritophilus* Oberholser. San Miguel Island, Panama.

Bahama Green Heron, *Butorides virescens bahamensis* (Brewster). The Bahama Islands.

Cuba Green Heron, *Butorides virescens cubanus* Oberholser. The Greater Antilles and east in the Lesser Antilles to Guadeloupe Island.

St. Christopher Green Heron, *Butorides virescens christophorensis* Oberholser. St. Christopher Island, Lesser Antilles.

Dominica Green Heron, *Butorides virescens dominicanus* Oberholser. Dominica Island, Lesser Antilles.

Martinique Green Heron, *Butorides virescens maculatus* (Boddaert). Martinique Island, Lesser Antilles.

St. Lucia Green Heron, *Butorides virescens lucianus* Oberholser. St. Lucia Island, Lesser Antilles.

Barbados Green Heron, *Butorides virescens barbadensis* Oberholser. Barbados Island, Lesser Antilles.

Grenada Green Heron, *Butorides virescens grenadensis* Oberholser. Grenada Island to St. Vincent Island, Lesser Antilles.

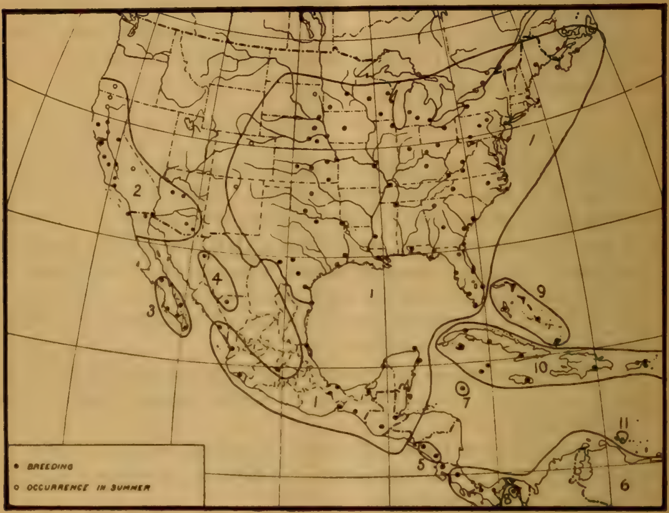

FIG. 19.—Green heron (*Butorides virescens*). Subspecies: 1, *virescens*; 2, *anthonyi*; 3, *frazari*; 4, *eremonomus*; 5, *mesatus*; 6, *hypernotius*; 7, *saturatus*; 8, *margaritophilus*; 9, *bahamensis*; 10, *cubanus*; 11, *curacensis*; seven other subspecies are on as many islands of the Lesser Antilles.

Tobago Green Heron, *Butorides virescens tobagensis* Oberholser. Tobago Island, Lesser Antilles.

Curaçao Green Heron, *Butorides virescens curacensis* Oberholser. Curaçao Island, off the coast of Venezuela.

[**Lembeye Green Heron.** *Butorides brunescens* (Lembeye).

Resident in Cuba and the Isle of Pines.]

[**Striated Heron.** *Butorides striata* (Linnæus).

A resident species occurring commonly in northern South America south to Peru and Argentina. The only record north of South America is that of a specimen taken May, 1904, on the savanna of Panama (Thayer and Bangs).]

Black-crowned Night Heron. *Nycticorax nycticorax naevius* (Boddaert).

Range.—The black-crowned night heron, including all of its various forms, is one of the most widely distributed of birds. In the

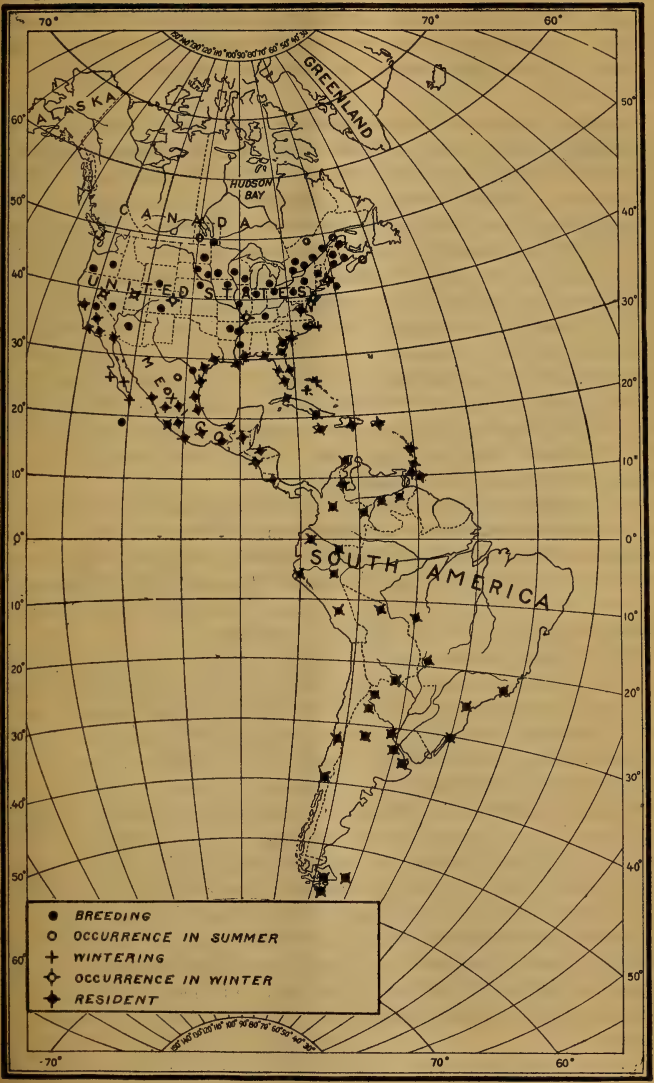
ALASKA
GREENLAND
HUDSON BAY
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER
+ WINTERING
OCCURRENCE IN WINTER
RESIDENT

FIG. 20.—Black-crowned night heron (*Nycticorax nycticorax naevius*).

Eastern Hemisphere it occurs throughout Africa and north to southern and central Europe and thence east across Asia to China and Japan. The subspecies *naevius* occupies nearly the whole of the Western Hemisphere, north to southern Canada and south to Patagonia.

Breeding range.—The black-crowned night heron breeds north to Woodstock, N. B. (Adney); Quebec City, Canada (Dionne); Ottawa, Ontario (White); Toronto, Ontario (Nash); Rochester, Mich. (Bretherton); Oak Center, Wis. (Hatch); Lake Andrew, Minn. (Skoglund); Shoal Lake, Manitoba (Gunn); Sterling, Colo. (Cary); Laramie, Wyo. (Knight); Bear Lake, Utah (Bailey); Ruby Valley, Nev. (Bailey); and Willows, Oreg. (Bailey). Stragglers have been noted north to Halifax, N. S., about November 18, 1888, and July 4, 1889 (Austen); St. John, N. B., January 5, 1887 (Chamberlain), and April 20, 1888 (Banks); Mount Stewart, Prince Edward Island (MacSwain); Gaspe, Quebec, July 14, 1881 (Brewster); Lake Mistassini, Quebec, August 6, 1885 (Macoun); near Burks Falls, Ontario, May, 1899 (Fleming); 140 miles west of Winnipeg, Manitoba (Talbot); Portland, Oreg., July 29, 1908 (Jewett); and Douglas County, Wash., early June, 1906 (Bowles).

The breeding range includes Mexico, Central America, the whole of South America south to the Falkland Islands (Wagler) and southern Patagonia (Oustelet), the Greater Antilles, several of the Lesser Antilles—Granada (Sharpe), Trinidad (Leotaud), St. Christopher (Cory), St. Vincent (Sharpe), Tobago (Jardine), and Antigua (Cory)—and the Hawaiian Islands (Henshaw).

Winter range.—Throughout the larger part of its extensive breeding range, the black-crowned night heron is nonmigratory, but it retires for the winter from much of its United States summer home and occurs at that season in Florida, the entire Gulf coast, and north on the Atlantic coast to Pea Island, N. C. (Bishop), and on the Pacific slope to Marysville, Cal. (Belding). A few have been noted in winter in Bermuda (Hurdis); at Cambridge, Mass. (Allen); Providence, R. I. (Billson); Shelter Island, N. Y. (Griffing); Trenton, N. J. (Abbott); Anna, Ill. (Butler); Barr Lake, Colo. (Smith); Provo Lake, Utah (Yarrow and Henshaw); and Fallon, Nev. (Mills). The Zoological Park at Washington, D. C., has a large flying cage in which many black-crowned night herons live all the year outdoors. A year or two after this was built, herons appeared on the outside as well as the inside of the cage, and these wild birds have become rather common through the summer and a few remain all winter.

Spring migration.

Place.	Number of years' records.	Average date of spring arrival.	Earliest date of spring arrival.
Philadelphia, Pa. (near)	9	Apr. 22	Feb. 15, 1902
Morristown, N. J	3	Apr. 22	Apr. 19, 1885
New Providence, N. J	3	Apr. 10	Mar. 23, 1884
New York, N. Y. (near)	8	Apr. 16	Mar. 4, 1895
Hartford, Conn	7	Apr. 9	Mar. 28, 1902
Providence, R. I	6	Apr. 6	Mar. 17, 1907
Southeastern Massachusetts	9	Apr. 24	Mar. 28, 1893
Monadnock, N. H			Apr. 11, 1902
Portland, Me			Apr. 18, 1906
Quebec City, Canada	3	Apr. 14	Apr. 10, 1905
Rodney, Miss	2	Mar. 24	Mar. 22, 1884
St. Louis, Mo	3	Apr. 22	Apr. 20, 1886
Urbana, Ill	2	Mar. 31	Mar. 26, 1904
Rockford, Ill			Apr. 5, 1890
Chicago, Ill	9	Apr. 23	Apr. 8, 1894
Sandusky, Ohio	3	Apr. 16	Apr. 14, 1902
Ottawa, Ontario	2	Apr. 24	Apr. 18, 1894
Grinnell, Iowa	3	Apr. 17	Apr. 8, 1887
Forest City, Iowa			Apr. 3, 1897
Heron Lake, Minn	9	Apr. 12	Apr. 6, 1890
East-central Kansas	5	Apr. 19	Apr. 15, 1907
Eastern Nebraska	5	Apr. 22	Apr. 2, 1904
Larimore, N. Dak			May 1, 1893
Denver, Colo. (near)	5	Apr. 25	Apr. 21, 1906

As would be expected from a species with such an extended range, the eggs are deposited at widely different times in different parts of the breeding range. While eggs are most commonly found in Chile during the months of October and November (Germain), in Cuba, the eggs are usually deposited in April and May (Gundlach); San Mateo, Fla., March 29, 1882 (specimens in U. S. National Museum); Alachua County, Fla., April 18, 1890 (Pearson); Charleston, S. C., April 25, 1908 (Wayne); Charleston, S. C., April 7, 1910 (Wayne) (unusually early); Mattamuskeet Lake, N. C., April 30, 1908 (Pearson); Baltimore, Md., April 30, 1892 (Gray); Syracuse, N. Y., May 14, 1881 (Rich); Portland, Conn., April 17, 1872 (Merriam); Essex County, Mass., May 12, 1896 (Mann); Penobscot Bay, Me., May 26, 1897 (Knight); Philo, Ill., May 12, 1902 (Hess); Manawa Lake, Iowa, May 15, 1904 (Trostler); near San Francisco, Cal., April 21, 1904 (Finley).

Eggs were just hatching April 13, 1895, at Tallahassee, Fla., which must have been laid in March (Williams); young just out of the nest June 20, 1903, at Falmouth, Me. (Norton); young in nest September 15, 1901, at Alameda, Cal. (Cohen); full-grown young April 23, 1878, at Lomita, Tex. (Sennett). The average date of finding eggs at Barr Lake, Colo., was May 12, earliest May 9, 1909, but young in nest May 24, 1907, indicated that some eggs had been laid at a still earlier date (Rockwell).

Fall migration.

Place.	Number of years' records.	Average date of the last one seen.	Latest date of the last one seen.
Philadelphia, Pa. (near)	3	Oct. 23	Nov. 7, 1893
New York, N. Y. (near)	4	Oct. 8	Oct. 17, 1904
Hartford, Conn			Oct. 11, 1888
Providence, R. I	4	Oct. 24	Nov. 22, 1908
Southeastern Massachusetts	6	Oct. 10	Nov. 6, 1890
Durham, N. H			Oct. 1, 1900
Portland, Me			Sept. 16, 1907
Montreal, Canada	4	Sept. 13	Oct. 11, 1895
Quebec City, Canada			Oct. 15, 1894
Chicago, Ill	7	Sept. 23	Oct. 20, 1906
Ottawa, Ontario	9	Oct. 13	Oct. 27, 1894
Delavan, Wis	2	Sept. 23	Sept. 24, 1894
Heron Lake, Minn			Nov. 14, 1885
Richmond, Kans			Oct. 15, 1885
Lincoln, Nebr			Oct. 27, 1900
Huron, S. Dak			Oct. 18, 1887
Sioux Falls, S. Dak			Nov. 20, 1910
Barr Lake, Colo	2	Oct. 7	Oct. 11, 1908

[**Agami Heron.** *Agamia agami* (Gmelin).

A nonmigratory species ranging west to Palenque, Chiapas (Nelson and Goldman), and to Rio Coatzacoalcos, Vera Cruz (Sumichrast). It is rare and local in British Honduras, Guatemala, and Costa Rica, more common in Panama, and has a wide range in northern South America, south to Yurimaguas, Peru, and to Matto Grasso, Brazil.]

Yellow-crowned Night Heron. *Nyctanassa violacea* (Linnæus).

Range.—Temperate and tropical America, north to South Carolina, Illinois, Kansas, and Lower California; south throughout the West Indies and Central America to Brazil and Peru.

Breeding range.—The yellow-crowned night heron is a common breeding bird in Florida and the lower parts of the Gulf States. On the Atlantic coast it breeds north to Charleston, S. C. (Wayne). It nests much farther north, however, in the Mississippi Valley even at the mouth of the Illinois River (Widmann); to Mount Carmel, Ill. (Nelson); Bicknell, Ind. (Chansler); Crooked Creek, Kans. (Goss); Fort Reno, Okla. (Merrill); Gurley, Tex. (Howell); and Laredo, Tex. (Butcher). The northern limit of the breeding range on the Pacific coast is found at Mazatlan, Sinaloa, at Magdalena Bay, Lower California, and on Socorro Island. The species is a common breeder in the Bahamas and the West Indies, and less commonly and somewhat locally throughout Central America and northern South America south to Paranagua, Brazil (Pelzeln); and Tumbez, Peru (Taczanowski).

Winter range.—The yellow-crowned night heron seems to desert the United States during the winter, though an injured bird spent the winter of 1909–10 at Upper Matecumbe Key, Fla. (Brodhead), and two birds were seen during January, 1912, near Brownsville,

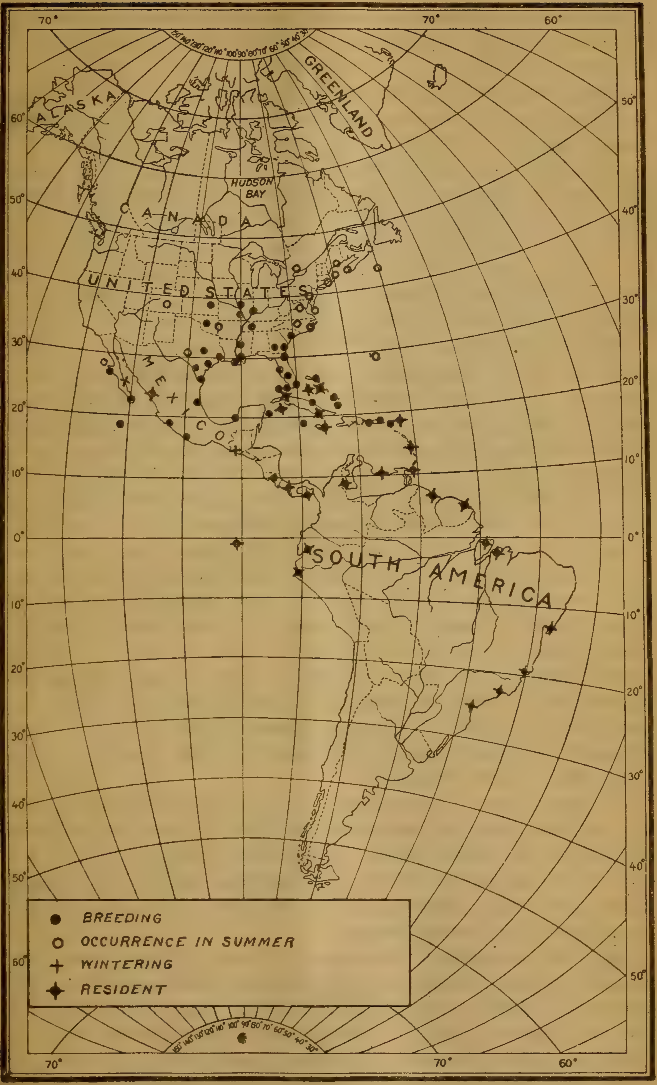
ALASKA
GREENLAND
HUDSON BAY
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
● BREEDING
○ OCCURRENCE IN SUMMER
+ WINTERING
✦ RESIDENT

Fig. 21.—Yellow-crowned night heron (*Nyctanassa violacea*).

Tex. (Smith). It winters, however, in Cuba (Gundlach); Andros Island, Bahamas (Bonhote); Santa Ana, Vera Cruz (Ferrari-Perez); Mazatlan, Sinaloa (Lawrence); and La Paz, Lower California (Brewster).

Spring migration.—The earliest migrants reached Catfish Creek, Polk County, Fla., February 14, 1901 (specimen in U. S. National Museum); Savannah, Ga., March 28, 1909 (Perry); Charleston, S. C., average March 25, earliest March 23, 1907 (Wayne); New Orleans, La., average March 19, earliest March 9, 1895 (Allison); Rodney, Miss., average March 25, earliest March 20, 1890 (Mabbett); St. Louis, Mo., April 10 (Hurter); Bicknell, Ind., April 13, 1908 (Chansler); Corpus Christi, Tex., March 8, 1877 (Sennett); Galveston, Tex., March 20, 1892 (Lloyd); Dallas, Tex., March 28, 1898 (Mayer); Crooked Creek, Kans., April 17, 1878 (Goss).

The yellow-crowned night heron is apt to appear in districts north of the breeding range, as shown by the following records: Bermuda, April, 1848, September, 1849 (Hurdis); Raleigh, N. C., June 25, 1894 (Brimley); Cobb Island, Va. (Rives); Washington, D. C., August, 1901 (Palmer); Woodbine, N. J., May 23, 1892 (Stone); Freeport, N. Y., April, 1893 (Dutcher); Bellport, N. Y., 1897 (Babson); Wading River, N. Y., April, 1901 (Hoffman); Orient, N. Y., May 4, 1905 (Braislin); Newport, R. I., June 15, 1778 (Howe); Tiverton, R. I., April 23, 1886 (Howe and Sturtevant); Lynn, Mass., October, 1862 (Allen); Provincetown, Mass., March 8, 1891 (Small); Deering, Me., April 13, 1901 (Brock); Portland, Me., April 11, 1906 (Norton); Hawk Point, N. S., late March, 1902 (Kennard); Sable Island, N. S., April 13, 1904 (Boutelier); Toronto, Ontario, August 15, 1898 (Williams); near Council Bluffs, Iowa, May 10, 1843 (Audubon), and May 1, 1892 (Trostler); Sabula, Iowa, September 15, 1892 (Giddings); Beatrice, Nebr., July 19, 1901 (Swenk); Florence Lake, Nebr., August 23, 1903 (Trostler); Salida, Colo., May 1, 1908 (Warren).

The above dates indicate that at the time of the spring migration it is no rare thing for individuals of this species to journey farther north than they usually breed. These birds probably return in a few days to the normal breeding range, and then in July and August a second northward migration of a smaller number of individuals occurs after the breeding season.

Eggs are deposited in December in Brazil (Euler); San Miguel Island, Panama, March 14, 1904 (Thayer); Grenada, W. I., April and May (Wells); Cuba, April and May (Gundlach); Port Henderson, Jamaica, June 12, 1890 (Field); near Passage Key, Fla., April 18, 1906 (Pearson); Alachua County, Fla., April 25, 1888 (Pearson); Charleston, S. C., April 20, 1896 (Wayne); Wheatland, Ind., April 27, 1881 (Ridgway); Mount Carmel, Ill., May 6, 1874

(Nelson); Nueces County, Tex., May 22, 1884 (Benners); Socorro Island, Mexico, fledged young May 14, 1897 (Anthony). An unusually early nesting was that of birds which had already laid their eggs by March 23, 1907, at Charleston, S. C. (Wayne), while the eggs that were found hatched March 5, 1890, at Key West, Fla., must have been laid in early February.

[**Lineated Tiger-bittern.** *Tigrisoma lineatum* (Boddaert).

The lineated tiger-bittern ranges north to Panama, where it has been taken at Lion Hill, March, 1900 (Brown), and at Rio Indio, February 23, 1911 (Goldman). Thence it spreads over much of northern South America, south to Peru (Pebas and Yurimaguas) and to Barretos, Sao Paulo, Brazil.]

[**Nicaraguan Tiger-bittern.** *Tigrisoma excellens* Ridgway.

Restricted to Middle America, where it has been taken from the Segovia River, Honduras (Townsend), to the Rio Escondido, Nicaragua (Richmond).]

[**Mexican Tiger-bittern.** *Heterocnus mexicanus* (Swainson).

The Mexican tiger-bittern is one of the common members of the family in Mexico and Central America and ranges north almost to the United States, to Alamos, Sonora; Victoria, Tamaulipas; and Cozumel Island, Yucatan. The southern limit is found in Panama, where it has been taken east to the Bay of Panama (Kellett and Wood) and to the line of the Panama Railroad (McLeannan).]

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